JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED
BY THOMAS P. JONES, M. D.

MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY, AND OF THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA, PROFESSOR OF CHEMISTRY IN THE MEDICAL DEPARTMENT OF THE COLUMBIAN COLLEGE, AND LATE PROFESSOR OF MECHANICS IN THE FRANKLIN INSTITUTE, AND SUPERINTENDENT OF THE PATENT OFFICE AT WASHINGTON.

VOL. VIII.

Vol. 12.

NEW SERIES.

PHILADELPHIA:
PUBLISHED BY THE FRANKLIN INSTITUTE, AT THEIR HALL;
THOMPSON & HOMANS, WASHINGTON CITY; G. & C. & H. CARVILL, NEW YORK;
AND MONROE & FRANCIS, BOSTON.

J. HARDING, PRINTER.

1831

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JULY, 1831.

On the Quadrature of the Circle, by the Editor.

Although the practicability of making a perpetual motion is a question settled in the negative by every man well versed in the principles of mechanics; and although those acquainted in the higher geometry, have given up the attempt to square the circle, or, in other words, to find a square the area of which shall be exactly equal to that of a circle whose diameter is given; we are yet not unfrequently amused, through the medium of the journals of the day, with the assurance, that what has eluded the researches of the most able engineers, and the most profound mathematicians, has been *luckily* discovered by some sciolist, without the use of the midnight lamp. In a former number of this journal, we gave some account of the most prominent schemes of perpetual motion, and it is our design in the present article to notice the attempts which have been made to square the circle.

We have been directed to this subject by some recent publications in the papers of Washington city, in which a gentleman in one of the public offices, has triumphantly announced his most complete success in this difficult, if not impossible problem; and informs us that he has entrusted his secret to fifteen individuals, all of whom are perfectly satisfied of the correctness of his principles. We are not told how many out of the fifteen are capable of forming a judgment upon the subject, but we happen, however, to know that at least one of the number is unacquainted with the meaning of decimals; and we also know that those most capable of deciding the question are not, and have no desire to be, of the number of the initiated. A few years ago

a similar announcement was made in the Richmond papers; but when the plan was presented to the public, it proved to be one of those gross mechanical modes of approximation, which have been repeatedly proposed. A cube and a sphere were to be made, and their relative masses ascertained hydrostatically. An approximation as inferior to that which the mathematician has obtained, as matter is inferior to mind. Others have proposed to cut a square and a circle out of a plate of metal, or other substance, both equal in thickness, and then to weigh them, ignorant of the fact that neither the weight or dimensions of such articles is capable of being ascertained with a millionth part of the correctness with which the mathematician has squared the circle.

The subjoined account of what has been proposed, and done, upon this subject, is abstracted entirely from Montucla, as contained in his "Recreations in Mathematics," translated by Hutton.

Montucla divides those who have pursued this inquiry into two classes; the first, geometricians, who, aware of the difficulty or impossibility of the problem, have not been led away by illusions, but have confined themselves to the finding out the most exact methods of approximation. The other class, those who scarcely acquainted with the elements of geometry, and hardly knowing on what principle the problem depends, have twisted and turned the circle in every direction, and have laboured, like the unfortunate Ixion, eternally rolling the heavy burden, without bringing it any nearer to its place of destination. When one error is pointed out to them, they soon return with their propositions in a new, but equally contemptible form; and unhesitatingly contest the best established truths in the elements of geometry, appearing to believe themselves specially appointed by Heaven to reveal truths to mankind, the discovery of which is withheld from the learned, that it may be bestowed upon idiots.

In the time of Aristophanes, the question of the quadrature had already become celebrated, as in order to ridicule Meto, he introduces him on the stage, promising to square the circle.

We first find in the writings of Archimedes, the announcement of the truth, that the circle is equal to the rectangle of half the circumference by the radius. Still something more was necessary, namely, to determine the proportions between the circumference and the diameter; and although he was unable to accomplish this with mathematical precision, he showed that the diameter being 1, the circumference would be more than $3\frac{10}{71}$, and less than $3\frac{10}{70}$, or $3\frac{1}{7}$.

Since that time, if great exactness be not required, in order to find the ratio of the diameter to the circumference, the proportion of 1 to $3\frac{1}{7}$, or of 7 to 22 is employed; that is to say, the diameter is tripled, and $\frac{1}{7}$ of it is added: this seventh is never neglected, but by the most ignorant workmen.

Among the modern geometricians, the first who made any addition to our knowledge on this subject was Peter Metius, of the Netherlands; whose name was mentioned in connexion with the discovery of the telescope in our last number. He ascertained that the propor-

tion between the diameter and the circumference of the circle was very nearly expressed by the terms as 113 to 355; the error being scarcely the ten-millionth part of the circumference.

The celebrated James Gregory of Scotland, undertook, in the year 1668, to demonstrate the absolute impossibility of the quadrature of the circle, and although his conclusions were not universally admitted, they have never been disproved. He gave several very ingenious methods for approaching nearer to the measure of the circle than had been previously done.

The numbers expressing the proportions between the diameter of a circle and its circumference were carried out by M. de Lagny, to 127 figures, or decimals; by which it was shown that if the diameter be represented by unity, followed by 127 ciphers, the 128 figures which he has given as representing the circumference, and which commences with 314, and terminates with 446, will be less than the circumference, whilst it will be greater if the last figure be increased by unity. If we suppose a circle, the diameter of which is *a thousand million times* greater than the distance of the sun from the earth, the error in the circumference would be *a thousand million of times* less than the thickness of a hair.

Euler has pointed out the method by which we may go still further, but there are few who would not pronounce the labour to be superfluous. The supposition, therefore, that there is in England a standing reward of £10,000, or of any other large amount, awaiting the discoverer of the quadrature, must be placed among the prevailing vulgar errors; for with all her liberality, Britain does not give such rewards for the discovery of that which would be of no practical utility whatever.

Among those who have miscarried in their attempts to solve this problem, or who have fallen into ridiculous errors respecting it, the following are noticed by Montucla.

The celebrated Joseph Scaliger, who had no great esteem for geometricians, desirous of showing to them the superiority of a man of letters, in solving, by way of amusement, what had so long puzzled them, attempted the quadrature of the circle, and seriously imagined that he had discovered it. The quantity which he gave was a little less than the inscribed dodecagon. It was therefore an easy task to refute him, which was done by several mathematicians. The only effect produced upon Scaliger was, to throw him into a violent passion, and induce him to pour forth a torrent of indecent abuse upon the geometricians, and to confirm him more than ever in the opinion than they were destitute of common sense.

The celebrated Danish astronomer, Longomontanus, pretended to prove that the diameter of a circle is to the circumference exactly as 100,000 is to 314,185. The famous Hobbes imagined also that he had discovered this long sought secret; and upon being refuted by Dr. Wallis, he published a work with a design to prove that the whole system of geometry was founded upon false reasoning.

A certain M. Liger pretended that he had found out the quadrature of the circle, and commenced by demonstrating that the square

root of 24 was the same as that of 25; and of 50 the same as that of 49. This he attempted, not by geometrical reasoning, which he set at nought, but by mechanical contrivances, aided by figures.

M. Clerget made the wonderful discovery that a circle is a polygon with a determinate number of sides, and he thence deduced the magnitude of the point where two unequal spheres touch each other. He demonstrated also the impossibility of the motion of the earth. The affinity of these questions with each other has never been perceived by any other philosopher.

M. Mathulon, a manufacturer of stuffs at Lyons, undertook to act as a geometrician and mechanist, and in support of his pretensions announced that he had discovered the quadrature of the circle, and the perpetual motion. He deposited 1000 crowns to be awarded to any person who should prove that he was in error. M. Nicole effectually did this, and the thousand crowns were awarded to him, and were presented by him to the general hospital at Lyons.

A similar offer of a sum nearly double the amount, was afterwards made by an individual more distinguished for the possession of money than of mathematical learning. His method was to divide a circle into four equal parts by perpendicular diameters, and then to turn these quadrants with their four right angles outwards, so as to form a square, which square he pretended was equal to the circle, although it was manifest that the parts could touch each other in points only, instead of in their whole extent. Three persons appeared as claimants for the reward, so ridiculously offered, but the tribunal at the Chatalet decided that a man's fortune ought not to suffer from the errors of his judgment, when those errors were not prejudicial to society. The author of this offer obtained a sentence from the Academy of Sciences, which was that he should study the elements of geometry; he, however, was still convinced that he had been treated with gross injustice, and that future ages would blush for that in which he lived. Although but few of the pretenders to this discovery cut a figure so completely ridiculous, it is nevertheless true that their propositions have all of them had their foundations in ignorance of geometry.

It may be acceptable to those unacquainted with geometry, to learn how a very close approximation may be made to the ratio between the circumference and the radius of a circle, which is in effect the same as discovering the quadrature. If a polygon of any number of sides be inscribed within a circle, and another be circumscribed, both touching it, the two areas thus formed can be ascertained by mensuration, and the exact circumference of each figure may be readily ascertained. Now it is evident that the circumference of the circle must be greater than the one, and less than the other of these polygons. Wellebord Snell, a countryman of Métius, laboured assiduously on this subject; he calculated a series of polygons, up to 5,242,880 sides, so that when it is pretended that a proportion between the diameter and circumference of the circle, his table furnishes the mode of refuting the pretension.

There is an ingenious and simple mechanical mode of proving that

the area of the circle is equal to the rectangle of one-half the circumference, by one-half the diameter. Or, in other words, is equal to that of a right angled parallelogram, two of whose sides are equal to one-half the circumference, and the other two to one-half the diameter. Suppose a circle to be taken, and radii to be drawn from its centre to its circumference, numerous, and at equal distances from each other; then let this circle be divided into two parts, each a semicircle; cut through the radial lines from the centre close to the circumference, and open each semicircle out, so that the semi-circumference of each part shall become a straight line, the points of one piece will fit exactly into the spaces of the other, and the rectangle in question will be formed.

On the Application of Anthracite Coal to the Drying of Tobacco. By ERSKINE HAZARD, *Esq. Engineer.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—I noticed in your valuable journal for this month that a patent had been taken out for a plan for curing tobacco. It immediately occurred to me that this object could be very easily effected by placing a grate, with a Lehigh coal* fire in it, in a "tight house" in which the tobacco is hung. The stove or grate to be a moveable article to be placed on the earth floor without any connexion with stove pipe or chimney—the crevices in the roof will furnish a sufficient vent for the gas. This stove or grate is simply a sheet iron

cylinder 12 to 14 inches diameter, and of the same length, with a grate at the lower end of it to hold the coal, and open at top, supported by three legs rivetted to it. It should have two eyes or handles rivetted to the top for the purpose of running a small bar of iron through, by which two persons can readily carry it while ignited from one place to another, or two holes punched through the cylinder near the top will answer the same purpose.

In a larger building, two or more of these stoves may be used and will produce any degree of heat that may be desired, and they will not cost more than two or three dollars each.

No danger need be apprehended of the gas arising from the combustion producing any unpleasant flavour in the tobacco—of this, the experience of the brewers who all dry their malt on this principle by permitting the gas to pass through the body of the grain on the kiln, and of many families in this city who constantly bake their bread, cakes, pies, puddings, &c. in the gas, (also on the same principle,) without imparting any peculiar flavour to them, is sufficient evidence.

It is very common at Mauch Chunk, when *seasoned lumber* is required, to pile the green lumber on posts, about eight feet above the ground, and enclose the whole with boards tacked to the pile to confine the heat, and then introduce a grate with coal into the inclo-

* Anthracite.

sure. The whole pile is thus completely dried in 6 or 8 days, and requires no other attention than to renew the coal in the grate three times in twenty-four hours. The Lehigh coal will be found a very convenient article applied in this way in all the processes where drying is requisite, and particularly in kiln-drying corn. By removing the grates from the building while the ashes are shaken out and the grate replenished with coal, no inconvenience will be experienced from dust.

As persons who are not accustomed to the use of Lehigh coal, may wish to try this plan, it may be well to state the mode of kindling the fire. Cover the grate with a *thin stratum* of Lehigh coal, then add a quarter of a peck of charcoal—apply your fire, fill up the grate with Lehigh coal, and then *let it alone.* To renew the fire—with a crooked poker clear out the ashes from the bottom of the grate and fill up with fresh coal. The bars of the grate should be an inch and a quarter apart.*

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, May 26, 1831.

Professor ALEXANDER D. BACHE was appointed chairman, *P. T.*

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Matthew Carey, Esq.

Marriott's Dictionary, 2 vols. quarto.

Cobbett's Weekly Register, 1 vol.

By Reuben S. Gilbert.

The Laws of the Province of Pennsylvania, collected in one volume by order of the Governor and Assembly of the said Province, 1714.

The Cabinet of Natural History and American Rural Sports, first 5 numbers.

By James Rowland, Jr.

Elements of Chemistry, by M. J. A. Chaptal.

Physical and Chemical Essays, translated from the Original Latin of Sir Torben Bergman, by Edmund Cullen, M. D.

A System of Practical surveying.

By James Mease, M. D.

Archives of Useful Knowledge, 3 vols.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

Recueil Industriel, for November and December, 1830.

Bibliothéque Physico-economique, for January and February, 1831.

Annales de Chimie et de Physique, for October and November, 1830.

* The difficulty upon this subject is to bring the coal and the tobacco together; they are the products of different regions, and where tobacco grows wood is plentiful and will be used.—EDITOR.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for October and November.

Programmes des Prix proposés by la Societé d'Encouragement pour l'Industrie Nationale, pour être Décernes, en 1831, 1832, 1833, *et* 1835.

Annales des Mines, No. 3, Vol. 7.

American Annals of Education and Instruction, for May.

Magazine of Useful and Entertaining Knowledge, for April.

Ladies' Book, for May.

Casket, for May.

The Southern Review, for May.

Southern Agriculturist, for January, February, March, April and May.

Museum of Foreign Literature, Science, and Arts, Vols. 14, 15, 16, 17, and Nos. 1, 2, 3, 4, 5, of vol. 18.

The chairman of the Committee on Inventions stated, that the committee had been engaged during the past month in examining several inventions submitted to them, and reports on some of them would be prepared to be submitted to the Institute at their next meeting.

Professor Johnson made some remarks on the subject proposed for discussion this evening, viz. on the best mode of securing the boilers, cylinders, and all other parts of steam engines against loss of heat by radiation and conduction, when it was on motion continued as the subject for the next meeting.

Dr. Hays rose, and after some prefatory remarks, stated in substance as follows. That an attack upon the scientific reputation of Dr. Godman, late Professor of Natural History in the Institute, having been made very recently by a lecturer on Geology, in a public lecture delivered in the hall of the Institute, at which many members of the Society were present; and that a thorough investigation of the subject having resulted in a complete refutation of the attack, he thought it would be interesting to the members of the Institute to be put in possession of the facts upon which the vindication of their late Professor rested.

The lecturer before alluded to, had stated to his class that the animal described by Dr. Godman as new, under the name of *Tetracaulodon Mastodontoideum*, was nothing more than the young of the common mastodon. In support of this, the lecturer had exhibited two lower jaw bones from the collection of the American Philosophical Society, one of which he stated to be that of a young animal, and showed the socket which had once contained the tooth characteristic of the animal described by Dr. Godman, while the other, which he said was that of an adult, was asserted by him to have contained no such socket. The lecturer had also exhibited a tusk which he said was the milk tusk of the young of the gigantic mastodon.

Doctor Hays proceeded to say, that the jaw exhibited by the lecturer as that of a young animal, had proved, on examination, to be that of an adult, as the dentition clearly showed, while in that admitted by the lecturer to be the jaw of an old animal, the remains of the socket

which had once contained a tusk was clearly to be seen. And further that the tusk exhibited by the lecturer as a milk tusk, was evidently that of an old animal.

Dr. H. stated that he had communicated to the American Philosophical Society, the proofs of the accuracy of the preceding statement.

A. D. Bache, *Chairman.*

J. Henry Bulkley, *Rec. Sec.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1831.

With Remarks and Exemplifications, by the Editor.

1. For making *Rifles for the sharpening of edge tools;* and a composition for polishing of all kinds of metals; Peleg Barlow, Amenia, Dutchess county, New York, March 1.

A machine is to be used for putting the composition which is employed, upon wooden strips, called rifles; there is to be one composition for grinding, and another for polishing. The machine to be used is particularly explained and distinctly claimed, but there is no drawing of it. The rifles are as follows:—

"For grinding. *Two* parts of white lead, ground in linseed oil, and *three* parts emery. Linseed oil to be added to the mixture in sufficient quantity to make a paste of suitable consistence. Before the paste is spread upon the rifle, a composition of white or red lead and linseed oil, to be applied to the rifle, and dried, before the paste, or cement is spread upon it."

"For polishing. *Two* parts of white lead ground in oil, and *three* parts of red oxide of iron.—To the mixture for polishing, oil in like manner to be added, until the composition becomes of a suitable consistence."

On turning to Vol. 4, p.175, it will be seen that a patent was obtained by Beriah Swift, living in the same county with Mr. Barlow, for *a rifle for sharpening scythes and other edge tools;* dated June 11th, 1829, which we have thus described.

"Emery, of suitable size, is to be fixed upon properly shaped strips of wood, by means of a mixture of oil, paint, and varnish, which, when dry, forms the substitute for the stones usually employed."

The validity of either claim may admit of some doubt, and it certainly would have puzzled the last patentee, to have distinguished his invention "from all other things before known."

---

2. For *making Axes by Machinery;* being an improvement upon the apparatus called the "oval axe machine;" Stephen Hyde, Williamsburgh, Hampshire county, Massachusetts, March 2.

The original machine was patented on the 29th of January, 1830,

and the present application is for an improvement upon the apparatus then claimed. Two dies, different in form from those originally used, constitute the present claim; they consist of an upper and lower die, and are intended for spreading the iron the width of the axe, and forming the lower part of the eye.

---

3. For an *Improvement in Lamps,* by applying the principle of the Argand lamp, to the common wick lamp; Lewis F. Gallup, Woodstock, Windsor county, Vermont, March 3.
(See specification.)

---

4. For a *Stove for burning Anthracite* and other fuel; Stephen C. Roe, New York, March 5. Patent assigned to James P. Allaire, of the same place.

The whole description is comprised in the following words.

"The stove is in the form of a truncated cone, terminating below in a cylinder; the top joined to a hemispherical cup, covered by a lid; or the cone may be without the cup. The pipe is joined near the top."

"What I claim is the conical form of the main body of the stove."

The drawing represents the stove described, both with and without the cup above mentioned. There is no fire-place door, the fuel being put in at top, by removing the lid. The cylindrical part extends no higher than is necessary to form an ash pit, the part containing the fuel being included in the cone.

These stoves are, we believe, made of sheet iron, and lined with fire clay, and usually of very small dimensions, say 18 inches in height, and perhaps 6 or 7 in diameter at the base. They are certainly very simple in their structure, and we are told that the anthracite burns better in them than in stoves of any other form, and have no reason to doubt the correctness of the information.

---

5. For an improvement in *Locomotive Carriages, and Rails adapted thereto;* Emmor Kimber, Kimberton, Chester county, Pennsylvania, March 5.
(See specification.)

---

6. For an improvement in the mode of *raising Vessels out of the Water;* Joshua Cleeves, Elmira, Tioga county, New York, March 5.

It is proposed in this patent to raise a vessel perpendicularly, by means of levers. Wharves are to be built, forming a slip into which the vessel to be raised may enter. A strong frame is to be made, like a raft. This is to fit in between the wharves, and to be the platform upon which the vessel is to be supported. The frame is to be sunk so that the vessel may float in over it, and then be secured upon it in a vertical position, by proper bilgeways, &c. Along each side

of the platform vertical pieces of iron rise so as to project above the wharves, where they are to be operated upon by levers, which, it is stated, may be attached, and put into action, in various ways; there are to be poles, or other contrivances, for securing the uprights as the vessel is raised. When the platform has been elevated as high as low water mark, or to the height intended, sliding pieces of timber, ranged in each wharf for the purpose, are to have their ends pass under the edge of the platform to sustain it and the vessel thereon. The whole is described in very general terms, and no claim made. We apprehend that in a practical essay, with a large vessel, the raising with levers would present difficulties which would prove this mode to be very inferior to that of the screw dock, for which it is intended as a substitute.

---

7. For a *Knitting Machine;* John M'Mullin, and Joseph Hollen, Jr., Huntingdon county, Pennsylvania, March 5.

The machine for which this patent is taken manifests an uncommon degree of ingenuity on the part of the inventor. There is a working model of it deposited in the patent office, which we have seen in operation, and although not executed in a workmanlike manner, it operates sufficiently well to remove all doubt respecting the goodness of the work which it may be made to execute. The different parts of the machine are set in motion by the turning of a crank. The loops, or stitches of the article to be knit, hang upon pins, or teeth, which partially surround a horizontal wheel, and project upwards like the teeth of a crown wheel; the stocking is knit by it with the seam open, as in the common stocking frame. When the stitches have extended to a sufficient width, the motion of the crank is reversed, and the wheel is thus moved in an opposite direction.

We had thought of giving the specification, with an engraving of the machine, but shall not do this at present. Although we have spoken highly of the skill of the inventors, we do not believe that the machine will ever come into general use. In rapidity of execution it will fall far behind the stocking loom, and will not probably far exceed that of an expert knitter; besides this, it will be costly in the first instance, will be liable to disarrangement, and require more skill to repair it, than is usually found in country places.

---

8. For a *Thrashing Machine;* Joseph C. Gentry, Kensington, Philadelphia county, Pennsylvania, March 7.

We cannot afford room for the description of this machine, as it resembles so many others. The claim is as follows.

"What I claim as my invention is the twisted reversed screw auger whippers, and the twisted reversed square edged iron bars which form the circle over which the cylinder revolves, and the improvement in the frame or case through which the wind and dust produced by the velocity of the cylinder escapes."

9. For an improved *Block for Stereotype Plates;* Bradbury Hackett, Boston, Massachusetts, March 8.

The general structure of this block is like those commonly used, having fixed lips or catches on one edge, and moveable, or sliding catches on the other. The two sliding catches are forced up against the edge of the plate simultaneously by turning a key which fits on to a pinion. The teeth of this pinion act upon a sliding plate, each end of which forms a wedge, these wedges acting upon the two sliding lips, force them up. There is a spiral spring upon the shanks of the sliding slips, which force them out when relieved by turning the pinion, so as to withdraw the wedges. Some other modes of moving the wedges are described, and considered as included in the general principle.

The claim is "to so much and such parts of the machinery above described, in combination, as is or may be employed by moving the moveable lips to or from the stereotype plates, at one operation, by inclined planes, or wedges and springs, acted upon by a rack and pinion with a key, or in either of the ways mentioned; and the moving of the moveable lips to or from the stereotype plate at one operation."

---

10. For a *Thrashing Machine;* being an improvement in Douglass' Thrashing Machine; Fayette Cross, Sweden, Monroe county, New York, March 8.

As this thrashing machine resembles nearly all those which have preceded it, and is, we suppose, exactly like that of Mr. Douglass, except in the parts claimed, we proceed to furnish these distinguishing characteristics, which are thus set forth.

"The improvement which I claim, is, the introduction of winged gudgeons on the end of the cylinder, which is fastened to the gudgeons by iron wedges; and I also claim the invention of the rakes as represented."

It so happens that "the rakes as represented," are not to be found in the drawing; so that however excellent and original this part may be, we are not enabled to pass upon it the commendations it may merit. Should it prove equal, in point of *invention*, to the application of winged gudeons in the ends of the shaft, we shall be at a loss to find any terms in which we can express our admiration of it.

---

11. For a mode of *Propelling Rail-way Carriages;* Abraham Pawling, city of Philadelphia, March 9.

This patent is taken for a very complex mode of communicating the power applied to a vertical shaft, by a crank, or lever, to the propelling of a rail-way carriage. A wheel, or pulley, is fixed upon a vertical shaft, and from this, endless chains or bands pass round pulleys on the axes of the wheels. There are tightening pulleys to preserve the tension of the band, or chains. The grooves on the wheels upon which the chains run, are furnished with what are call-

ed clasps, or springs, which it is apprehended will have a favourable effect on the chain which passes over them. The claim is to the clasps with joints and springs, or screws and bolts, for preventing the chain, or band, from slipping; and the position, combination, and the general arrangements of the parts thereof, for producing the desired result.

---

12. For *Manufacturing Malleable Iron;* Seth Boyden, Newark, Essex county, New Jersey, March 9.

"*Specification.* The improvement consists in mixing rosin, pitch, or tar, with bituminous coal, and applying it as fuel for melting and converting crude or pig iron into malleable castings. The coal is pulverized, or broken in pieces of the size suited to the furnace grate, and mixed with rosin, pitch, or tar, in a proportion as the intense heat is desired, and applied in quantities diminishing in proportion as the rosin is increased."

Seth Boyden.

The foregoing contains the whole of the specification; the flame produced will undoubtedly have the effect of keeping off atmospheric air, and in this way protect the metal from oxidation. We do not perceive any other principle upon which it can operate in producing the effect of rendering the iron malleable.

---

13. For an improved mode of *applying Water to Water Wheels;* Joseph Michener, Clinton county, Ohio, March 9.

The wheel used is the common flutter wheel, which is to have eight buckets. The wall of the dam is not to be built vertically, but is to incline two inches towards the wheel. The water is to pass through a funnel, or opening, above the wheel. The arms supporting the buckets are not to form radii with the shaft of the wheel, but are to be set back, to prevent the water falling in towards the shaft. The water is to act upon three buckets at once.

" I claim the setting of the arms back, which prevents the water falling towards the shaft, which will give more power on the wheel; also the inclination of the breast of the dam; and also the fall funnel, and applying the water, or action of three buckets at a time."

Brief as we have been, we have used more words than the patentee in his whole specification, wishing to enable our readers to perceive the whole merit of his invention.

---

14. For an improvement in *Gas Metres;* H. Robinson, Boston, Suffolk county, Massachusetts, March 10.

The object of this improvement is " the introduction of water from the reservoir to the metre at the water line of the metre, by which means the water in the metre is kept at an equal height, though the pressure of the gas in the metre be ever so variable. Also the excluding of the water of the metre and reservoir from the atmosphere,

and thereby preventing the offensive odour that would otherwise be exhaled from it."

It is unnecessary to describe the particular mode in which this is done, as it would not be intelligible without a drawing, and would interest but few of our readers. A patent was obtained on the 11th of June, 1830, by Henry B. Williams, of Baltimore, for a method of effecting the same object, under the erroneous title of an improvement in gasometers.

---

15. For manufacturing *Cast Iron Door Knockers, with Brass Plates;* Increase Wilson, New London, New London county, Connecticut, March 11.

The specification is in the following words.

"The usual mode, heretofore, of manufacturing cast iron door knockers, with brass plates, has been to fasten on the brass plates after the knockers are cast, by means of solder, screws, or rivets. My improvement consists in casting the knockers directly on the brass plates; which may be done by first casting the inside of the brass plates with tin, lead, or other metals which fuse at a lower temperature than brass. The brass plates are then secured in their proper place in the moulds, and the iron poured in, (as is usual in casting iron,) which will readily unite to the brass plates, and secure them on more firmly, and better than is done in the usual way with rivets, &c. INCREASE WILSON."

---

16. For a machine for *Cutting large Wooden Screws*, for pressing hay, tobacco, cotton, &c.; John Morrison, Hardingsburg, Dearborne county, Indiana, March 12.

This machine is no other than the screw box commonly used for cutting bench screws, and screws of wood generally. The patentee, although he talks of "having invented," says at the close of his specification, "all I claim as new, and as my invention, is the augmenting and modifying the small screw cutting principle, so as to cut large wooden screws, without injury, and placing it perpendicular so as to apply power sufficient to cut it with one going over."

We know of nothing more easy than to become an inventor, if making an old and well known instrument somewhat larger than ordinary can give a claim to this title.

---

17. For a machine for *Separating the Knots, Knobs, &c. from the Pulp used in Paper Making*, before the sheet is formed; and also for graduating the quantity of pulp necessary to form the sheet; Solomon Stimpson, Newbury, Orange county, Vermont, March 12.

The machine for clearing the pulp, consists of a tub, which may be 2 feet in diameter; within this is placed a metal cylinder, or curb, which fits close to the bottom of the tub. This may be twenty inches in diameter, and eight inches in width. Around the upper edge of

it there are longitudinal openings to admit the pulp to pass through. The pulp is pumped up from the chest, and is admitted through a tube into the inside of the curb. Arms with dashers revolve within this curb, and drive the pulp against the openings where the finer parts pass through, whilst the knots are retained. A spout leading from the space between the curb and the tub, conducts the prepared pulp, to form the sheet. There is a cover to the whole to prevent the pulp from being dashed over.

To regulate the quantity of pulp which shall be supplied, the tube which conducts it into the curb, is in the form of a funnel; the pulp pumped into this keeps it filled, and any surplus runs over, and back again into the chest. A stop cock in the tube, between the funnel and its inner end, regulates the quantity which shall pass in.

---

18. For a *machine to be attached to a common Loom, for Weaving Figured Cloth;* George Deterick, of Lansing, and Jonathan Conger, of Groton, Tompkins county, New York, March 12.

This machine is to be placed in a room above the loom, to which it is connected by means of ropes and treadles; pins are so placed in a cylinder, or board, as to form the intended pattern, and operates in a way very similar to the apparatus well known to weavers; but which would be intelligible to few others even with the assistance of the drawing.

---

19. For a *Machine for Grinding Apples;* Silas Freeman, Jr. New Marlborough, Berkshire county, Massachusetts, March 14.

This machine consists of a hopper to contain the apples, and against the lower part of which revolves a wooden cylinder, surrounded by rows of teeth; the feeding may be adjusted by a screw.

The claim is to "the insertion and forming on the *outermost surface* of the cylinder, rows of teeth in the manner described." At some period or other this mode was undoubtedly new.

---

20. For an apparatus for *Preventing the Bursting, Collapsing, or overheating of Steam Boilers;* William A. Turner, Washington county, North Carolina, March 15.

To prevent the bursting of the boiler, "a large oblong square hole is to be cut in the top of the boiler;" this hole is stopped by a sliding shutter or door of iron, which is confined in a frame of iron surrounding the opening. This door forms a plane inclined to the top of the boiler, and slides in grooves in the manner of a sliding valve. According to the description given, this door is to be opened by levers connecting it with the safety valve, which, therefore, must open previously to the opening of this door.

To prevent the boiler from becoming overheated, there are to be metal rods passing through stuffing boxes in the top of the boiler, these metal rods are to be pressed down by weights, their ends in

the boiler are sustained by fusible metal supports, and when these melt, the rod descends, acts upon levers which turn a number of cocks, all admitting water on to the fire.

A valve opening inwards is to admit air as the boiler cools, and thus prevent collapsing.

We cannot follow the description through the long array of levers and other appendages specified and figured, unless we were of opinion that the proposed end was likely to be obtained by these contrivances; willing as we are, we cannot, however, stretch our faith or hopes so far. There is no claim made to any particular part.

---

21. For an *Edging Machine*, or "French horse," *for turning the Edges of Tin, copper, or sheet iron*, for roofing; John Woolley, city of New York, March 16.

The improvements made upon this machine do not stand sufficiently alone in the specification to enable us to distinguish them clearly. One, however, is stated to be the preventing of the closing or flattening of the ends of the bend first formed, by the subsequent bending of the other sides. This is effected by providing grooves in the machine into which these first formed edges pass.

The claims made are rather vague in their character, such as the privilege of varying the machine, and constructing it of different materials. But there is one claim which certainly belongs to another subject, as it makes no part of the edging machine. It is as follows.

"The subscriber claims the privilege of forming metal roofs in such a manner that they effectually resist the driving of rain. This is done by inserting a small piece of metal, (which has been previously bent by his machine,) over each notch in the corners of the sheets; these are to be locked in with them on the roof. These pieces may be secured by nails, and not being exposed to the water, are not so liable to rust. The old practice of driving nails through the sheets is thus dispensed with entirely."

---

22. For an improvement in the *Boiler and Furnace for Steam Engines;* Samuel Forbes, city of New York, March 17.

This consists of a furnace within a vertical boiler. A principal feature of 'the invention is the causing the bars that form the grate of the furnace to rise in a conical form, which greatly increases the surface by which the fuel is exposed to the action of the air. These bars all meet in the centre of the furnace, rise there above the surface of the fuel, and are surmounted by a cap, perforated with holes, to admit atmospheric air to mingle with the combustible gases extricated from the fuel, and thus to perfect their ignition. The claim is in the following words.

"What I claim as my invention is the particular mode of constructing the fire-place, with the grate rising conically, within a conical cavity. The cap piece for supplying air to the combustible gases. The mode of heating the fuel, and of supplying it to the fur-

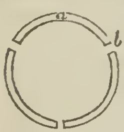
nace from the cylindrical chamber; and the general arrangement of the whole for the attainment of the ends proposed."

23. For an improvement in the *Grist Mill;* Joseph Yeamans, Ashtabula, Ashtabula county, Ohio, March 18.

This is another portable mill, in which the upper stone is to be the runner, and to be about 18 inches in diameter. The principal, and we believe the only difference between this machine and some others, is the manner in which the stone is held down. This is effected by the form given to the foot of the spindle, which is turned so as to have a neck in it a little above its point, or step. Two plates of metal, forming a collar, embrace this neck, and are screwed on to the bridge tree; there is consequently no loading necessary to the stone, as the bridge tree may be made to draw it down with any desired degree of force. There is no claim made.

24. For an improvement in the construction of *Lamps;* John W. Schulze and Joel Trull, Medford, Middlesex county, Massachusetts, March 19.

It is intended by this invention to adapt the argand burner, to lamps of the ordinary construction. The interior as well as the exterior of the flame being supplied with air. The wick is divided into three or more parts, each having its appropriate tube. These tubes, *a*, &c. are segments of an ammulus, or ring, and when placed together assume a form resembling that containing the wick in the argand lamp. An opening is made in each tube for picking up the wicks, as in the common lamp. The air is admitted to the outside of the flame, under the glass burner, it being elevated upon knobs for that purpose; and to the inside of the flame through the spaces, *b*, &c. between the tubes, they not being in contact with each other. The three separate flames are made to unite in one, by a conical ferule, or ring, placed just above the tubes; this inclines the flame inwards; the inner current of air is thrown upon the flame by means of a button. The apparatus is ingeniously contrived, and well described. We are somewhat apprehensive that the interior current may prove insufficient for perfect combustion, but suppose, that on this score, the patentees have satisfied themselves by experiment.



The particular construction of such parts as appear to be new, are claimed, with the mode of combining them with those before known and used.

25. For an improvement in the construction of *Trusses for Ruptures;* Jesse C. Earle, Baltimore, Maryland, March 19.

The principal object aimed at in this truss is to adjust the pad with great exactness, so that it may have the desired bearing. The pad is supported on an arm attached to the main spring of the truss. It is fastened to this truss by a screw in its centre, affording the

means of removing it from one part of the arm to the other. The arm swivels upon the point by which it is affixed to the main spring, allowing the pad to be turned downwards, or upwards, or to assume any other direction required.

---

26. For a *machine for manufacturing Boots, or Shoes,* with nails or pegs; Nicholson Millis, city of New York, March 21.

This machine has a frame with two uprights, between which uprights there is a sliding piece, operating as a ram, or driver, to strike upon a moveable piece below it; under this is placed the leather or shoe, to be acted upon. A shaft, turned by a crank, carries wipers which lift the sliding piece, and allow it to fall. The soles are to be cut out by a steel knife bent in the form required for that purpose. The holes are all to be punched at once by means of a circular rim, having points instead of cutting edges. The nails, or pegs, after being placed in the holes, are also all driven home together, the bottom of the last being covered with iron, or other hard metal, to turn or clench their points.

There is no claim made to the machine, but to "the privilege of substituting cog wheels for band wheels; of constructing the machine of wood, iron, or any other suitable metal," &c.

The cutting and punching apparatus have been long used, although not operated upon by a machine exactly like that here described.

---

27. For an improved *Auger,* called the serpentine screw auger; George Shetter, York, York county, Pennsylvania, March 21.

A patent was obtained by the same gentleman for the *serpentine screw auger*, on the 10th of September, 1829. The thread of this auger is not formed by twisting, but in the manner of those cork screws which have a continued shank, or shaft, or, in fact, like common wood screws. The difference between this and the auger formerly patented, consists in its having a double bit, or cutting edge, the other having had but one. This, it is said, makes it bore more easily and steadily than the original serpentine screw auger.

---

28. For a *Thrashing Machine;* Abraham W. Summers, Gates, Monroe county, New York, March 21.

The cylinder of this machine has rows of teeth set along it, from end to end, and between each of these rows there is what the patentee calls a *float*, which is a piece of hoop iron set edgewise, and projecting about five-eighths of an inch from the cylinder. The hollow segment is formed of straight bars, set side by side, and presenting an acute angle to the cylinder. The patentee says—

"The principal features of this improvement are as follows. The placing of the floats between the rows of teeth, which prevent wet wheat or straw forming a wisp round the cylinder. The bars of the

concave made diamonting, and the acute angle placed within an eighth of an inch of the teeth, and so close together as to prevent the white caps passing between them. Thereby every kernel is compelled to pass over the whole concave, which clears it from chaff, and smut, and does not cut the kernel."

---

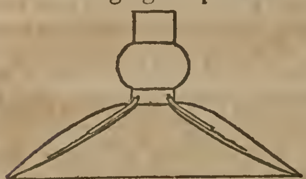
29. For a *machine for Splitting, Shaving, and Cutting Leather, Skins, &c.;* Augustus S. Dawley, Boston, Massachusetts, March 22.

(See specification.)

---

30. For an improvement in the *Chandelier, or Hanging Lamps;* William Lawrence, Meriden, New Haven county, Connecticut, March 23.

This hanging lamp has a reservoir, or chamber, in a form somewhat resembling that of the astral lamp now in such general use. This reservoir is composed of two shells soldered at their lower edges, and allowing a space between their upper edges for flat tubes with wicks to pass out. It is proposed, sometimes, to cover the funnel shaped opening at the lower edge with a pane of glass, capable of being removed for cleaning; the glass is represented in the drawing by the straight line at bottom.



"By this improvement much of the light of the lamp will be reflected and concentrated from the inner surface of the globe glasses, and pass diverging by means of the opening through the body of the lamp, and thus prevent the shadow of that, and cause an equal diffusion of light; they are peculiarly adapted to work shops, binacles, &c. and may be made of all sizes."

"I do not claim as my invention, the suspended lamp, the glass globed tubes, and the reflector in common use; nor the opening simply through the body of the lamp. But I do claim as my invention the means of making them altogether more useful than heretofore, viz. by the bell shaped opening of the well; the tubes for the wicks; the feeders; the bottom glass; and the mode of construction and suspension, as above described, and thereby its adaptation to produce the results specified above."

---

31. For a mode of constructing *Wheel Carriages,* called "the rolling lever carriage;" Henry Chapman, Corinth, Saratoga county, New York, March 24.

For one, but not a first, account of this *invention*, we refer our readers to Vol. 4, p. 259, where it will be seen that a patent for an improvement in the application of wheels to carriages, issued to George Bridgman of Connecticut, on the 16th of July, 1829. As these improvements, so called, are identical, we shall not repeat

what we then said. The plan is to sustain the load upon a carriage with small wheels, and to allow the rims of those wheels to rest upon the insides of the rims of large wheels.

---

32. For a *new Alloy, or Compound Metal, applicable to the Sheathing of Ships*, and other useful purposes; John Revere, M. D. a citizen of the United States, but now residing in England, March 24.

(See specification.)

---

33. For an improvement in the construction of *Steam Boats, for the passage of rapids;* Thomas Blanchard, Machinist, Springfield, Hampden county, Massachusetts, March 28.

A boat to ascend rapids it is observed, should be wide at the bows, flat in the bottom, and rising gently, say about an inch in the foot, so that the current striking under it may tend to raise the bow and pass directly under the boat, not passing, as in keel boats, towards the sides. The stern should rise from the bottom at a greater angle than the bow.

"The construction of the boat designed by this applicant is adapted by its lightness and strength for the passage of rapids, the requisite strength being gained by skilful combinations of carpentry, consisting essentially in the support of the floor, the bow, and stern, by an arch extending from the extremity of the bow to the extremity of the stern. This arch may be constructed in many different modes of carpentry."

A mode of constructing this bracing arch is described at considerable length, and we are informed that "there are other modes of constructing the arch familiar to men skilled in the art and means of carpentry."

The boat is to be propelled by a paddle wheel, by means of a steam engine, with a horizontal cylinder.

"The principle of this improvement consists in the combination of a steam engine of adequate power, and convenient structure, with a flat bottom boat, having the bottom, bow, and stern, with the water wheel placed therein, as aforesaid, sustained and stiffened by an arch, substantially, as aforesaid, or by arches as hereinafter described."

There appears in the description of the distinguishing feature of this boat, a want of explicitness; the invention is not sufficiently tangible, and the patentee appears to be aware of this. He observes that "there have been heretofore flat bottom boats, and it may be that steam engines have been placed in them, with water wheels in the stern; but this applicant avers that no boat having a bow, bottom, and stern, of the construction aforesaid, and a water wheel placed as aforesaid, sustained and stiffened by an arch, or arches, of carpentry, had ever been invented, or known, and used, before this applicant invented his combination. This applicant having construct-

ed said combination, and put it in successful operation in the Allegheny river."

34. For an improvement in the *mode of Mixing Paint;* Jonathan Linnell, Jr., Orleans, Barnstable county, Massachusetts, March 26.

(See specification.)

35. For a *Machine for Pressing Bricks;* Archibald M'Clung, Fairfield, Rockbridge county, Virginia, March 26.

A firm bench is prepared, upon which lies a stout piece of timber capable of sliding backward and forward, horizontally, on the bench. Each end of this piece of wood is faced with iron, and forms a follower, or piston, by which the pressure is to be effected. The piston is moved towards either end by means of a lever, which, when the piston is in the middle of the bench, stands vertically; its upper part forms a handle, and upon its lower end there are teeth which take into teeth forming a rack upon the piston. There is an iron mould at each end of the bench, to receive a brick, and when the lever is drawn down to press a brick, at one end, it touches a rod, which, operating upon another lever, raises a pressed brick from the mould at the opposite end.

The claim is to "the machine for pressing bricks as before described."

36. For an improvement in the *Loom for Weaving Webbing, Bed Binding, Tape, &c.;* Asa G. Bill and George Spalding, Middletown, Middlesex county, Connecticut, March 28.

Without the whole specification and drawing we cannot attempt an explanation of the improvements proposed, nor will the claims throw much light upon the subject. Those interested, therefore, must have recourse to the patent office for full information. The claims are to "the taking up of the goods as wove, by calender rollers.—The slanted or mortised lever for regulating the motion of the calender rollers.—The springing of the harness by rods.—The holding of the shuttle after it passes through the warp."

37. For an improved mode of *Instituting and Drawing Lotteries;* James Kenny Casey, Baltimore, Maryland, March 28.

(See specification.)

38. For an improved *Machine for Pressing Bricks;* John Sites, Harrisonburg, Rockingham county, Virginia, March 29.

In this machine the brick, contained in a suitable mould, is operated upon simultaneously by two pistons, one above and the other below the mould. A system of levers is so arranged that one of them shall act upon the upper, the other on the lower piston. The

particular arrangement adapted is not a subject for mere verbal description; the whole machine is claimed, the terms used being the same as those in No. 35.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in Lamps, by applying, in a new way, the principle of the Argand Lamp, to the common Wick lamp. Granted to LEWIS T. GALLUP, *Woodstock, Windsor county, Vermont, March* 3, 1831.

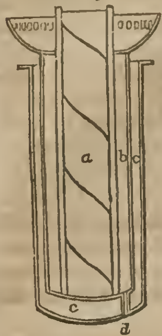
THE essential character of the invention consists in adapting the argand burner to lamps with imperforate bottoms.

To effect this, a cylindrical tube is constructed concentric with, and interior to, the wick, destined to convey the current of air through its centre, and this tube is furnished with a spiral groove upon its exterior surface, for the purpose of raising or depressing the wick, by a revolution of the tube which contains it, in precisely the same manner as the common argand lamp. The air tube, however, instead of terminating in an orifice at the bottom of the lamp, receives its current of air through a channel which opens beside the wick, at the top of the lamp.

The channel is furnished in either of the following methods. In the first the interior, or air tube, is to be enclosed in a second, which is concentric with it, and so much larger, that the intermediate space is sufficient for the reception of the wick and the moveable tube which contains it. This tube, as it is enclosed by a third, or exterior tube, may, for the convenience of description, be called the middle tube. The exterior tube is so much larger than the middle one, that the space between them is equal to, or greater than the capacity of the interior tube, so that the descending current of air, which passes through this space, furnishes a supply to the interior tube through which it ascends, as in the common argand lamp. The exterior tube is closed at the bottom, but descends far enough below the other to leave room for the current of air which passes around under the space between the middle and interior tube, and this space, which, as before remarked, contains the wick, is closed at the bottom by a circular zone, so as to prevent all communication between the air passage and the oil that supplies the wick. To supply the wick with oil, one or more tubes pass across the air passage, opening upon the inside of the middle, and outside of the exterior tube, to which tubes they are fastened by solder.

According to the second plan proposed for admitting the atmosphere to the bottom, the air tube itself is constructed just as before, except that it is closed at the bottom. The descending current of air is thus furnished by one or more tubes, which pass down by the side of the wick from the top of the lamp, and enter the bottom of the tube, to which they are joined by solder.

Gallup's Improved Lamp.



In both these cases, the ascending current of air which supplies the exterior of the flame, passes through a circular row of perforations in the flanch which supports the chimney of the lamp as in the common argand burner, and an air hole made through the lamp, or cylinder flanch, to let the air into the oil which surrounds the outer cylinder, or on the common argand principle.

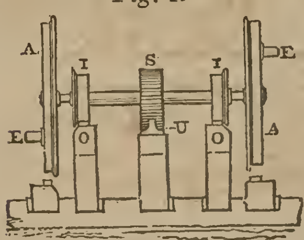
LEWIS F. GALLUP.

a, spiral tube interior to the wick.
b, space for the wick.
c, space for air to pass to the interior tube.
d, pipe for admitting air to the wick.

Specification of a patent for Locomotive Carriages, and Rail-roads adapted thereto. Granted to EMMOR KIMBER, *Kimberton, Chester county, Pennsylvania, March* 5, 1831.

THE invention consists principally in employing the power of locomotive engines on acclivities, in such manner, that by diminishing the velocity of its carriage, the effective force of the engine will be increased in the same ratio—thereby superseding the necessity of stationary engines.

Fig. 1.



A, A, Fig. 1st and 2nd, are the common wheels of a locomotive carriage, (3 feet in diameter,) to which the power of the engine is applied, by a wrist or crank at E, E. On these wheels the locomotive carriage runs upon a plane, drawing the train forward on the rails, nearly nine feet for every evolution. I, I, are two smaller wheels, (attached to A, A, or separate,) 1 foot in diameter, and placed upon the same axle with A, A. To ascend acclivities the locomotive carriage runs upon I, I, upon their own rails, O, O, raising the common wheels clear from their rails,—and therefore the carriage with the train moves forward only *three* feet for every revolution.

The diameter of the wheels, being as three to one, the engine employs three times as much power in a given space on the smaller wheels, as on the common ones—but the carriage and train move forward on the rails proportionably slower, and so of wheels of any other proportions, as four to one, five to one, &c.

On the middle of the fore axle is placed a cog wheel, S, of like diameter with the smaller wheels, to work free in the cog rail, U, to prevent slipping on great ascents. This use of the cog wheel is

known and has been variously proposed and tried. The improvement consists in substituting one cog wheel and its rail in the centre, in the stead of mixed rails, and cog wheels on both sides of locomotive carriages.

W, on Fig. 2, is a drag, or pall, that may be attached to locomotive carriages, and every car in their train to work upon the cog rail, U. Its use is well known to prevent a slip or slide in cases of accidents on great acclivities, but it derives new importance from its connexion with the cog rail, U, elevated in the middle of the road.

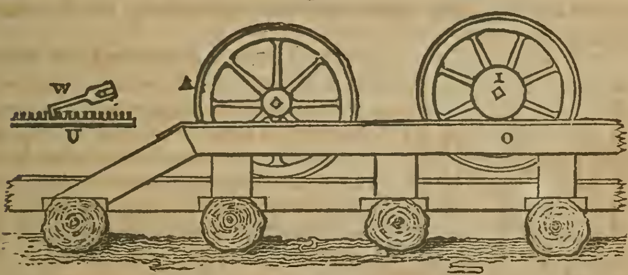
The ascending rails, O, O, and U, may be so constructed, as to rest upon the foundations with the common rails, and be raised to their proper height by blocks: they are only used in ascending acclivities, and for the small wheels. The hind wheels of the locomotive carriage, and the wheels of all the cars in the train, run on the common rails.

In this specification the wheels on the fore axle only are mentioned, because the power is considered as applied to the fore wheels. If the power should be applied to the hind wheels instead, or in part on both fore and hind, the principle would not thereby be changed. The small additional wheels on either, or on both, would be the application of power described and claimed as my invention.

EMMOR KIMBER.

Side View of Kimber's Rail-way and Carriage.

Fig. 2.



Abstract of the specification of a patent for a Machine for Splitting, Shaving, and Cutting Leather, Skins, and other substances. Granted to AUGUSTUS S. DAWLEY, *Boston, Massachusetts, March* 22, 1831.

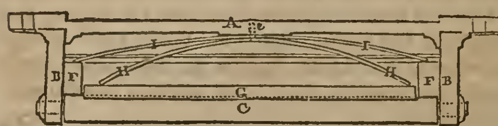
THIS improvement rests upon a combination of machinery in a manner new and hitherto unused, to effect with ease, precision, and rapidity, the shaving, splitting, or cutting of leather, skins, and other substances, in any desired thickness, breadth, and length. Every piece of the machinery used in this invention may have been used before separately, and for other purposes, and the combination only is here claimed.

Fig. 1.

Fig. 1, in the drawing, is a perpendicular view of the machine in its place, as fitted for operation. Fig. 2, is a view of the back side of it. Fig. 3, is a section cut from front to rear at the place marked *f*, *f*, Fig. 1.

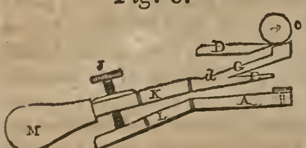
A, Figs. 2 and 3, is a bed-plate, of cast iron, increased in thickness towards its centre, to double the thickness of the other parts, in order to give it the strength necessary for the bearing of the screw by which the moving plate is moved on its pivots. At each end of the bed-plate is a screw hole, *a*, *a*, Fig. 1, to fasten the machine to a block or table.

Fig. 2.



B, B, Figs. 1 and 2, are upright shoulders, on plates running across to sustain the machinery. C, Figs. 1, 2, and 3, is a polished wrought iron roller, turning freely on its axis, and supported by B, B. This serves as a gauge to regulate the thickness to which the leather or skin is intended to be cut. Its bearings may be so regulated that the roller may be brought nearer to, or removed farther from the edge of the knife at pleasure.

Fig. 3.



D, Figs. 1 and 3, is the knife, or cutting plate, fastened by nuts *b*, *b*, its edge resting nearly under the centre of the roller C.

E. Figs. 1 and 3, is the moveable plate, made as strong as the bed-plate. F, F, Figs. 1 and 2, are two shoulders, or upright plates on E, and of the same thickness and width; they lie within the upright plates on the bed-plate, and are fastened to them by the pivots *c*, *c*, Fig. 1. The shoulders of the moving plate move on their pivots to the extent required to vary the position of the edge of the knife. The motion of the moving plate and knife are effected by means of the screw J, and the spring I.

C, on Figs. 2 and 3, represents the shaving plate; its use is to guide the water part of the skin which is cut off, obliquely down from the edge of the knife. The front of the shaving plate, where it rests on the moveable plate, is secured to the shoulders on the moving plate by pivots, *d*, *d*, Fig. 1, on which pivots it turns freely. Its junction is shown also at *d*, Fig. 3. The back part of the shaving plate is nearly a square bar, and is supported by the spring, H, as seen in

Fig. 2. The leather to be cut enters between this bar and the roller, as seen Fig. 3. The springs H and I, are fastened to the bed-plate by a rivet, shown at *e*, Fig. 2. The spring H must have sufficient strength to sustain the C against the skin to be cut, so as to keep it against the roller.

The knife is graduated by means of the spring I, and the screw J. That screw passes through a hole tapped in the lip K, Figs. 1 and 3.

The lips, K and L, which are projections from the bed-plate and moveable plate, are depressed, or sloped downward, for the purpose of permitting the strip of leather, and shaving, to pass freely over the screw.

M, is a wooden handle at the end of the lip on the moveable plate, for convenience in handling the machine.

The leather introduced between C and G may be drawn through in any convenient mode.

It will be observed by inspecting the machine, that the knife plate is so fastened that it is impossible for it to slip back; and as the edge of the knife wears away, the screws or nuts are readily so adjusted that the edge may be brought into the desired position by sliding the plate towards the collar, and the arrangement for thus easily changing the position of the edge of the knife, is also an advantage over the former mode of fixing the knife in shaving or cutting machines.

Specification of a patent for an improvement in the mode of mixing Paint. Granted to Jonathan Linnell, Jr., *Orleans, Barnstable county, Massachusetts, March* 26, 1831.

Take one pound of unslacked stone lime, and add to it seven pints of warm water put these into an air tight vessel, and let them stand about two hours, or until the lime be well slacked, then separate the liquid from the sediment and put it into another air tight vessel. Take two ounces of sugar of lead and dissolve it in a pint of pure fresh water, and add this to the lime water. Then add linseed oil in quantity equal to two-thirds of the above mixture, and stir the whole well together till it forms a complete body, before mixing it with the paint.

The above composition is for *inside* painting.

For *outside* painting, take one pound of unslacked stone lime and put it into four quarts of warm water, and slack it as before. Dissolve two ounces of sugar of lead in a pint of clear fresh water, as before, and add to it the lime water; to this add linseed oil in quantity equal to the whole of the last mentioned mixture, and stir them till they form a complete body, and then mix them with the paint.

Amongst the advantages which this paint, mixed as above, possesses over common paint, is, that it requires no driers of any kind, and for a given quantity of work, less oil is required.

What I claim as my invention, and which I wish to secure by letters patent, is the mode of mixing paint as above described.

JONATHAN LINNELL, Jr.

Remarks by the Editor.—This patent is essentially the same with that of Mr. Metcalf, noticed at page 378 of the last volume. In that, soap and water were used, in this, lime and water, the effect of the lime being to convert a portion of the oil into soap. The remarks formerly made apply with equal force to the present patent, namely, that the effect will be to render the paint less durable, the binding property residing in the oil exclusively.

Specification of a patent for an improvement in the mode of Instituting and Drawing Lotteries, and of renewing and perpetuating them at pleasure. Granted to JAMES K. CASEY, *formerly of New York, but now residing near Baltimore, in Maryland, March* 28, 1831.

To all to whom these presents shall come:—be it known, that I, James Kenny Casey, Gentleman, have invented a new and useful improvement, being a mode of instituting and drawing lotteries, as well as renewing and perpetuating them at pleasure, without those excitements and appeals which are now so constantly resorted to, and which are alike injurious to the public morals and to the condition of the poorer classes of society, who should be assiduously excluded from all modes of enterprise inconsistent with their means and their duties.

This method of forming, drawing, and renewing lotteries, consists of any given number of tickets, or debentures, issued under the authority of any state government, for the benefit of the state, or of the general government of the United States, for the benefit of the nation, or otherwise, not inconsistent with the laws of a state, or of the United States.

And of this number of tickets, or debentures, a certain declared number shall be fairly drawn out of the whole mass, which shall each be entitled to the amount, or prize, which may be previously affixed to the order in which it is drawn: and this sum shall, without any delay or deduction whatever, be paid to the holder, less the amount of one ticket in the ensuing lottery with which the holder of the prize shall be furnished. Thus, if the ticket, from its number and the order in which it is drawn, be entitled to $100,000, the fortunate holder, (provided tickets cost $50 each,) shall instantly receive in cash $99,950, and one ticket in the then immediately ensuing lottery; and if his number only draws a $50 prize, he will only receive another ticket for the following lottery: and if his ticket be amongst the undrawn numbers, it will only be entitled to one-half, or thereabouts, of the original cost of a ticket; which proportion is only available towards the purchase of a ticket in the then ensuing lottery, by which means the drawing of one lottery always effects the sale of another,

as each ticket and each share of a ticket act separately, and are not entitled, by combination, to enter on a purchase in a new lottery; for instance, two undrawn halves cannot purchase one half, but each must act for itself, and the holder make up the balance in cash and buy two halves. Thus about half a million of dollars for the common security and the benefit of the state, or the nation, would always be in hand.

I shall now, for the purpose of making my improvement, and the principle upon which it is founded, and upon which it acts, more clearly understood, detail the particulars of the plan as it would exhibit itself upon a scale of 20,000 tickets, or numbers, each ticket at 50 dollars, and no share less than a quarter, which, of course, would cost $\$12\frac{50}{100}$. And here it may be necessary to remark, as the lottery, from its own nature, would spin itself out into endless duration, that if any ticket, or shareholder, were desirous of selling, either before drawing, or during the intervals of drawing, the market price would always be obtainable; and, from the clear, and decided superiority of the plan, there can be little or no doubt that the price of tickets and shares must always carry a very handsome premium.

20,000 tickets, or debentures, at $50,				$1,000,000
Off a small per centage—say 5,				50,000
For immediate distribution,				$950,000
1	prize of	$125,000	$125,000	
1	do.	100,000	100,000	
1	do.	50,000	50,000	
1	do.	40,000	40,000	
1	do.	12,050	12,050	
2	do.	12,000	24,000	
5	do.	10,000	50,000	
10	do.	1,000	10,000	
20	do.	500	10,000	
100	do.	100	10,000	
500	do.	50	25,000	
642	drawn			
19,358	undrawn	25	493,950	
				950,000

Of the drawn numbers, consisting of 642 tickets, the prizes may be assigned, in any amount, or in any order in which they may come from the wheel; for instance,

Amount for distribution without deduction or delay,					$950,000
1st drawn			$50,000	$50,000	
10	next,	(2nd, &c.)	1,000	10,000	
1	do.	(12th,)	12,050	12,050	
20	do.	(13th, &c.)	500	10,000	
1	do.	(33d,)	125,000	125,000	
250	do.	(34th, &c.)	50	12,500	
1	do.	(284th,)	40,000	40,000	

100	do.	(285th, &c.)	100		$10,000
5	do.	(285th, &c.)	10,000	-	50,000
100	do.	(390th, &c.)	50	-	5,000
1	do.	(490th,)	12,000	-	12,000
100	do.	(491st, &c.)	50	-	5,000
1	do.	(591st,)	12,000	-	12,000
50	do.	(592nd, &c.)	50	-	2,500
1	do.	(642nd,)	100,000	-	100,000
642 drawn,					
19,358 undrawn,		$25 -	-		493,950
20,000					950,000

The great advantage, and, indeed, what I shall call the chief glory of this plan is, that it must inflict a death blow upon all those schemes of morbid excitement, and of complicated fraud and treachery which have hitherto acted, without one moment's intermission, upon those who, from the poverty of their circumstances, and the desperation of their hopes, and calculations, are undoubtedly the least protected parts of society.

And should the public convenience, or interest, require a change of the scale, or amount, involved in the drawing, or in any way make it adviseable at any time to work out the old lottery, the same may be done at the termination of any drawing, by paying off in cash, both the drawn and undrawn numbers once every third year, or less, or more frequently, as it may seem just, or desirable. And, to avoid any loss from stolen, mislaid, or destroyed tickets, or shares, it is desirable that each purchaser of one or more tickets, or shares, should assign to the number, or numbers, thereof, a name as well as location, (real or imaginary,) to be registered, and mentioned, when payment is required.

In testimony that the foregoing is a true description of my improvement in forming, drawing, and continuing, or terminating and renewing lotteries, upon principles alike fair and intelligible, and with the hope of attracting those who now waste their time, money, and morals, at Faro-tables, or other places of unlicensed, improper, and unfair adventure, and to give to speculations of this kind, all the equality and justice of which from their nature they are susceptible, I have hereto set my hand at Baltimore, in the county of Baltimore, and state of Maryland, this first day of February, eighteen hundred and thirty. JAMES KENNY CASEY.

Specification of a patent for a new Alloy, or Compound Metal, applicable to the Sheathing of Ships, and other useful purposes. Granted to JOHN REVERE, *M. D. a citizen of the United States, but now residing in England, March* 24, 1801.

MY invention, or discovery, of a new alloy or compound metal, consists of zinc and copper combined in the following proportions,

viz. Zinc, ninety-five parts—copper, five parts, by weight. To form a complete union of these two metals in the above proportions, so that an alloy suited to the above named useful purposes may be formed, I find the following a convenient method. Having weighed out the above named metals, in the above named proportions, I proceed to melt them in separate vessels. As soon as the copper is melted, I add to it a part of the zinc. The precise quantity is not important, but I add as much zinc as the crucible will, conveniently, contain. I prefer to add the zinc to the melted copper, while it, (the zinc,) is in a solid state. By agitation, or stirring, and exposing them to a suitable temperature, I thus cause the copper, and a portion of the zinc completely to combine. A portion of the zinc being thus combined with the copper, as soon as the remainder of the zinc, contained in a different vessel, is melted, I add it to the zinc and copper, and by stirring cause as complete a union as possible of the zinc and copper, in the above named proportions. To prevent the combustion of the zinc, which is apt to occur when exposed to the temperature of melted copper, I, from time to time, throw into the vessel containing the melted copper and zinc, some flux, as charcoal pulverized, or common salt. As my object in doing this is to exclude the air and thus prevent the combustion of the zinc, I add a sufficient quantity to cover the surface of the metals. The alloy thus formed may then be cast into ingots to be rolled into sheets, formed into nails, or cast into any other shape according to the useful purpose for which it is designed. The above I find a convenient method of combining those metals, but any other may be employed which will effect as complete and equal a union as possible of these two metals, in the above named proportions. But it is not necessary that the metals should be exactly in the above named proportions, for any other proportions, not exceeding on the one hand, ninety-one parts, by weight, of zinc, to nine parts of copper; or, on the other, ninety-eight parts of zinc to two of copper, will produce a useful effect. But about ninety-five parts of zinc to five of copper, will be found the most convenient in practice. For it is to be observed that as the proportion of copper to zinc exceeds five *per centum*, the alloy becomes more brittle and more difficult to work; and as it falls short of five *per centum*, the power of the alloy to resist corrosion is proportionably diminished.

Finally, I claim in the above specification to have discovered that when zinc has, as above described, a small portion of copper combined with it, its liability to corrode is essentially diminished, and that the compound metal thus formed may be advantageously employed for the sheathing of ships, and various other useful purposes.

John Revere.

ENGLISH PATENTS.

Patent granted to Joseph Harrison, *of Wortley Hall, in the parish of Tankersley, in the County of York, Gardener, and* Richard Gill Curtis, *of the same place, Glazier, for certain improvements in glazing Horticultural and other buildings.—Dated 6th October,* 1830.

The object of this patent is stated to be the giving a nearly even or plane surface on the upper side of the glass coverings of hot-houses, and other similar buildings.

The frame is furnished with a suitable number of bars, and they are both rebated on the under side for the admission of the panes of glass. A thin coat of white lead or putty is placed along the grooves, and the glass is fitted in, so that their edges overlap each other a little alternately at each end. A screw, (the head of which is supplied with a soft metal washer,) is inserted in the bars at the corner of the panes, and forms their support at this point, a piece of the glass being crumbled off to allow of the passage of the screw. Several small wedges are then driven into the framing, which are allowed to project a short distance, and complete the support of the glass.

Patent granted to Henry Calvert, *of the City of Lincoln, Gentleman, for an improvement in the mode of making Saddles, so as to avoid the danger and inconvenience occasioned by their slipping forward.—Dated 26th October,* 1830.

This improvement consists in attaching a spring or elastic plate to each saddle-tree point, which is effected in making up the saddle, and before it is what is technically called drawn on. The spring or plate is caused to project forward in a curved line from the tree-point, and bends slightly under the belly of the horse. The forward girth is buckled to the springs, and nearly touches the fore leg of the horse, and prevents the saddle from getting on the withers of the animal.

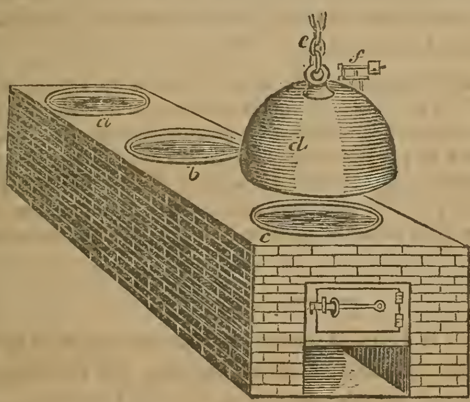
Patent granted to John M'Innes, *of Auchenreock, and of Woodburn, in the county of Stirling, North Britain, for the manufacture or preparation of certain substances, which he denominates British Tapioca, and the Cakes and the flour to be made from the same.—Dated 24th April,* 1830.

The patentee states his invention to be a manufacture or preparation of "bulberous-rooted" plants, indigenous to Great Britain, but more particularly the potatoe, from the strength of its mucilage, and its easy accessibility.

The roots, whether potatoes, parsnips, or beet-roots, are to be well cleansed and washed; they are then grated or mashed in the same way as in making potatoe starch, and the mucilage is passed through common sieves to separate it from the fibres; it is then exposed to the air to evaporate, and subsequently in a cast iron pan, which latter is placed on a fire to dry the contents thoroughly: these are constantly stirred to prevent their burning or sticking to the pan. When sufficiently dried it is ready to be ground, and is then suitable for the purposes to which flour is usually applied. It is observed by the patentee, that this is the same process he pursued for several years in the West Indies in the manufacture of Tapioca from the Cassada root, and that it will be found a very nutricious aliment either in conjunction with wheaten flour or separately.

To A. G. GARNETT, *of Demarara, Esq. a patent "for certain improvements in manufacturing Sugar," was granted on the 24th of July,* 1830, *and the specification was enrolled in the Enrolment Office on the 24th of January,* 1831.

THE principal improvement in Mr. Garnett's process, consists in the application of a dome-shaped iron cover, for the teach or concentrating pan suspended over it in such a manner as to be capable of almost instant application and removal, by which the process of supplying and removing the materials is greatly accelerated.



A perspective representation of this apparatus is here given: *a*, *b*, shows a series of clarifying pans, which are to be employed merely in the usual manner; and *c* represents a teach or concentrating pan with a dome-shaped cover, *d*, of cast iron, weighing about seven hundred pounds. This cover is suspended over the teach by a chain, *e*, which passes over a pulley and round a drum, or barrel, with a handle for raising and lowering the cover: *f* is a safety valve, through which the aqueous portion of the sirop escapes in the form of steam

through the safety valve. The cane juice having been clarified in the usual manner, is conveyed into the teach, and the cover applied; when the boiling, or evaporation of the aqueous particles will immediately commence and proceed with great rapidity: so that in the space of five minutes an additional quantity of sirop may be introduced, and in a few minutes more, a second supply will be required; and this continued for half an hour, when the teach will require to be employed and the operation recommenced. Therefore, the sugar in the teach may be changed every half hour: and as no time will be wasted in fitting the cover on the teach, much more work will be effected with the same labour and fuel. When the operation is completed the sugar is to be put into vessels of about six feet long, four feet wide, and two feet deep.

To M. Robinson, *of Great George Street, Westminster, a patent for "certain improvements in the process of making and purifying sugars," was granted on the 5th of August,* 1830, *and the specification was enrolled in the Enrolment Office on the 5th of February,* 1831.

This patentee applies his improvements to the purifying of the cane juice which is to be extracted in the usual way. He applies to the juice a saturated mixture of alum and lime, in the proportion of two pounds of the mixture to a hundred gallons of the juice. These being intimately mixed, the acid is to be neutralized by the application of milk of lime, in the proportion of three pounds to a hundred gallons. If there be an excess of acid it will be discovered by the application of the test paper usually employed by chemists to detect acids, and more milk of lime must be added; and if there be an excess of alkali, it may be discovered by the application of the test paper used for detecting alkalies, and more juice must be added. When the mixture ceases to effect either the test for acid or alkali, the impurities will be precipitated, and may thus be separated; and the juice thus purified is to be subjected to the usual mode of clarification and concentration; giving preference, however, to Howard's method. And the patentee claims as part of his invention, the application of steam heat to the evaporation of sugar in vacuo: using high pressure steam at about twenty pounds to the square inch.

Royal Ordinance of France, in relation to High Pressure Engines, (*May 7th,* 1828.)

(Continued from p. 406 of last vol.)

Charles, &c. &c.

Upon the report of our Minister of the Interior;

Having in view the ordinance of October 29th, 1823, in relation to high pressure engines.

By the advice of our Council of State;

We have ordered, and do order as follows:

Art. 1st. The proof-pressure prescribed by the ordinance of October 29th, 1823, is reduced, for boilers of copper or of rolled iron, to triple the pressure to which the boiler is subjected in the ordinary working of the engine. Manufacturers must give such thicknesses to boilers as shall enable them to bear the proof, without injury to the tenacity of the metal.

2nd. The boiler-tubes, for high pressure boilers, are subject to the rules prescribed for boilers, both in relation to proving and to inspection.

When the tubes are of a material requiring a different proof from that of the boiler, they must be proved separately.

In the contrary case, they may be proved with, or apart from, the boiler, as the manufacturer may wish.

In whatever way the proof has been applied, each boiler-tube shall be marked with a number denoting the working pressure of the engine, with the boiler of which the tube is to be connected.

3d. The cast iron cylinders of high pressure engines, and their jackets, must be proved at a pressure of five times that to which they are subjected in the working of the engine. After the proof, both the cylinders and jackets will be marked with the number denoting the ordinary working pressure of the engine.

4th. The pressure to be assumed as unity in determining the proof pressure, must be the bursting pressure to which the boilers, boiler-tubes, cylinders, and jackets, will be ordinarily exposed; that is, the whole working pressure diminished by one atmosphere.

5th. Our Minister of the Interior is charged with the execution of this Ordinance, which shall be inserted in the Bulletin of Laws.

Given, &c. May 7th, 1828.

(Signed,) CHARLES.

By order of the King.

(Signed,) DE MARTIGNAC,
Minister of the Interior.

Circular of the 1*st of August*, 1828, *to the Prefects of Departments, in relation to the Royal Ordinances of the 2nd April*, 1823, *and of 25th May*, 1828, *concerning boilers used in Steam Boats.*

SIR,—You are acquainted with the Royal Ordinance of 25th of May last, (Bulletin of Laws, No. 233, p. 497,) in relation to steam engines used in navigation.

An ordinance, bearing date April 2nd, 1823, prescribed certain regulations for steam boats; the subject required, however, more particular attention. In order the better to secure passengers and the crews of steam boats, as well as merchandise, against accident, it has been found indispensably necessary to place the *low pressure engines of steam boats*, and their boiler-tubes, under the operation of the rules prescribed by the Royal Ordinance of October 29, 1823, in

relation to *high pressure engines*, and by the ordinance of May 7, 1828, concerning the boilers and boiler-tubes of high pressure engines.

The use of boilers, or boiler-tubes, of *cast iron* on board of steam boats is prohibited.

The cast iron cylinders of the low pressure engines of steam boats, as well as their jackets, must be proved and marked in the manner prescribed by the ordinance of 7th of May, last, for cylinders, and their jackets, used in high pressure engines.

These are the principal particulars of the ordinance of May 25th, 1828. As they refer to the ordinances of October 29, 1823, and May 7, 1828, I can but call your attention again to the two sets of instructions which I had the honour to transmit to you on the 19th of May, 1825, and 16th of July, last, in relation to the execution of those ordinances. The table of thicknesses for wrought iron boilers, contained in the latter of the instructions referred to, may be used for the boilers now in question. In fact, that table beginning with two atmospheres, is applicable to low pressure boilers. It has not been deemed necessary to give the thicknesses corresponding to a working pressure of one atmosphere and a half, since manufacturers are in the habit of making boilers for so low a pressure thicker in proportion, than for higher pressures.

The Board of Inspection which you were required, by the 1st art. of the ordinance of April 2nd, 1823, to convene, will have new duties to perform. I trust they will see the importance of the new regulations, and will have them strictly executed.

I beg you to communicate to this board the instructions of May 7th, 1825, copies of which I again transmit to you, and of 12th July, last, annexed to my circular of the 16th of the same month.

I further request you to transmit these instructions to the proprietors of steam boats, and to the manufacturers of *low pressure engines for steam boats*, within your department.

They will see that the dies for marking the boilers may be had at the Royal Medallic Mint, Paris, and the fusible metal plates of M. Collardeau, &c.

I have thought it useful to transmit — copies of the ordinances of 2nd April, 1823, and 25th May, 1828, with the present circular. I request you to distribute the copies which I send you to those interested in the subjects of these ordinances.

The Engineers of Mines and of Civil Works are called upon to perform new duties. If I have required of them assiduity in their duties of inspection, and of you constant solicitude, in relation to the establishments where high pressure engines are used, I beg that they and you will take the same pains in the execution of the ordinance of 25th May, last, concerning *low pressure* engines used on board of steam boats.

It is evident that accidents to steam boat boilers, must be of great injury to industry; and more than this, painful to humanity on account of the number of victims, who, cut off from all means of

escape, must meet death by the waves, if they should not have been reached by the explosion.

I beg you, sir, to acknowledge the receipt of this.

I have the honour to be, &c. &c.

(Signed,) Becquey,

Counsellor of State, &c.

Royal Ordinance, (1823,) *in relation to Steam Boats.*

Louis, &c. &c.

Upon the report of the Minister of the Interior,

Having before us the law of 29th floreal, year 10, (19th May, 1802.)

Having also before us the decrees of the Prefect of the Gironde, of November 15, 1821, and March 27, 1823, in relation to the police of steam boats running upon the Garonne.

Having before us the observations and opinion of our Minister of Marine, of 27th August, 1822, upon the said decrees.

Having also the opinion of the Board of Civil Works of the 10th of October, following.

Considering that existing laws and regulations, applying to steam boats, do not give sufficient security to the crew and passengers, and that, therefore, it is necessary to resort to special regulations.

Considering, also, that it is important to establish, for the police of steam navigation already introduced upon several streams, general and uniform measures, leaving only to the local authorities the details flowing from these.

With the advice of our Council of State,

We have ordered and do order as follows:

Art. 1st. In all departments containing rivers, streams, or coasts, where steam boats may run, the Prefect shall organize one Board, or more, of practical men, to be presided over either by a chief Engineer of Civil Works, or, in his default, by an engineer of lower rank.

It shall be the duty of this Board, under the direction of the Prefect, to satisfy themselves that steam boats are of due strength, particularly in reference to the engine; that the engine is carefully kept in order, in all its parts, and presents no appearance of special liability to fracture, nor any dangerous deterioration.

2nd. No steam boat can be put in operation until after the Board shall have ascertained the strength of the parts and the good condition of the engine, nor until the Prefect shall have informed the proprietors that he has received and approved the report of the Board.

3d. The Board shall inspect quarterly every steam boat, and shall make a report thereon to the Prefect, in which shall be stated the measures to be pursued in case any defect should appear in the engine. Besides the quarterly visit of inspection, the Board shall make others, whenever directed by the Prefect.

4th. Steam boats are placed, in relation to the number of passen-

gers, the hour of starting, to the composition of the crew, and condition of the vessel, under the regulations in force upon the coasts, rivers, or streams, in relation to navigation. Consequently, when the boats navigate the waters of sea-board arrondisements, the captains must be provided with a permit, or register, and when navigating the waters of inland arrondisements, such boats shall be subject to the inspection of the port officers, as well as to regulations of the Prefect in relation to police at setting out and landing.

5th. The Minister of the Interior is charged with the execution of this ordinance.

Given, &c. April 2nd, 1823.

(Signed,) Louis.

By order of the King.

(Signed,) Corbiere,
Minister of the Interior.

Royal Ordinance in relation to Low Pressure Boilers, used in Steam Boats, 1828.

Charles, &c. &c.

Upon the report of our Minister of the Interior:

Seeing the ordinances of April 2nd, and October 29th, 1823, and of May 7th, 1828.

Wishing further to provide for safety in steam navigation by adding to the general and special regulations, already published, such others as experience has shown to be necessary.

With the advice of our council of state,

We have ordered, and do order as follows:

Art. 1st. The low pressure boilers, viz. those working at, or below, a pressure of two atmospheres, used in steam boats, as well as the boiler-tubes, are placed under the operation of the regulations prescribed, for the safety of the boilers and boiler tubes of high pressure engines, by articles 2, 3, 4, and 5, and the first paragraph of art. 7, of the ordinance of October 29, 1823, and by the ordinance of the 7th of May, 1828.

2nd. The use of cast iron boilers, on board of steam boats, is prohibited under every pressure.

3d. The cast iron cylinders, and their jackets of cast iron, used in the low pressure engines of steam boats, shall be proved and marked as is prescribed by the ordinance of May 7th, 1828, for the cylinders, and jackets, of high pressure engines.

4th. The preceding regulations as well as those of the ordinance of April 2nd, 1823, apply to stationary boats on board of which steam engines are used.

5th. The Board created by the ordinance of April 2nd, 1823, will attend to the execution of the preceding regulations and will make mention of the fact in their report.

6th. In case of infraction of the present ordinance the owners of

steam boats will be liable to the recall of their permits, without prejudice to the penalties which may be awarded by the courts.

7th. Our Minister of the Interior is charged with the execution of this ordinance, which will be inserted in the Bulletin of Laws.

Given, &c. May 25th, 1828.

(Signed,) CHARLES.

By order of the King.

(Signed,) DE MARTIGNAC,
Minister of the Interior.

Note upon the Method of Calculating the Thicknesses of Wrought Iron Boilers.

IN the preceding instructions, it was only necessary to give the formula for determining the thicknesses of wrought iron boilers; it has been deemed adviseable to state, in this note, the considerations whence this formula was derived.

It is supposed in what follows that the boiler is a cylinder with hemispherical ends. This form, it is well known, is the best for all boilers, and the only proper one for those of high pressure engines.

In order that a boiler of this form may be equally capable of resisting, at all points, interior pressures perpendicular to a plane passing through the axis of the cylinder, the hemispheric ends must have only half * the thickness of the cylindric part. In practice, the same thickness is, with propriety, given to the ends as to the cylindric part, since the sheets of metal used in forming the ends must be more injured in giving them the required form, than those constituting the body of the boiler. This being the case, it will be necessary to determine only the thickness required for the cylindric part of the boiler: this is given by the following formula.

$$t = \frac{d \times P}{2c} \; \ldots\ldots \; (a)$$

In this formula we obtain the thickness, (t,) in inches if the diameter of the boiler, (d,) has been expressed in inches. P is the whole

* Strictly speaking the thickness should be something less, but the difference is so small that it may be disregarded. Let t and t' be the thicknesses of two different boilers, the first being cylindric, the second spherical; all other things being the same in these boilers, and both in vacuo, we shall have

$$t' = t \times \left(\frac{-1 + \sqrt{a+1}}{a}\right)$$

a representing the ratio between the bursting pressure for a given surface and the tenacity of the material for the same surface. In the case in which this force is 7 atmospheres, (of 15 lbs.,) or 105 lbs. to the square inch, and the tenacity 37840 lbs. for the same surface, then $a = .002774840145$, and

$$t' = t \times \left(\frac{-1 + \sqrt{.002774840145 + 1}}{.002774840145}\right) = t \times .4995$$

interior pressure, and c the tenacity of the wrought iron, each being referred to the same amount of surface.*

This formula supposes the boiler to be in vacuo, but as it is pressed on the exterior by the atmosphere, the force tending to produce rupture is equal to the elasticity of the steam within, diminished by one atmosphere. Let p represent the pressure upon the unit of surface, and n the number by which the pressure of one atmosphere is to be multiplied to give the tension of the steam within a boiler; the pressure from within is np, that from without p. Consequently the bursting pressure upon a unit of surface is $np—p$, or $p\ (n—1,)$ substituting this value for P in the formula $(a,)$ it becomes

$$t = \frac{d \times p\,(n-1)}{2\,c} \;.\;.\;.\;.\;.\; (b)$$

The thickness of a boiler calculated by this formula would be too small, since the tenacity of the metal would be just equal to the force tending to burst the boiler. It remains to determine the addition which must be made to this thickness, to suit the circumstances of the case.

To meet the requirements of the ordinance of May 7th, 1828, this value of t should be multiplied by three in order to produce an equilibrium with the proof-pressure, if this product be multiplied by three, the boiler will not be injured by the proof to which it must be subjected. Multiplying the second member of equation (b) by 3×3, or 9, we shall have

$$t = \frac{d\,p\,(n-1)\,9}{2\,c} = \frac{d\,p\,(n-1) \times 4.5}{c} \;.\;.\;.\;.\;.\; (c)$$

If we take the square inch as unity of surface, $p = 15$ lbs.

In the case assumed, c represents the tenacity of rolled iron to the square inch; if the boiler were of copper, c would express the tenacity of the latter metal.

The tenacity of rolled iron is generally taken at 44,000 lbs. per square inch, which is the strength of iron of medium quality.

Below are the results of careful experiments upon the tenacity of hammered iron, of rolled iron, and of copper. The tenacities are referred to the same section, a square inch, and expressed in pounds and decimal parts of a pound.†

1. *Iron.*—The tenacity of very good forged iron was 63,730.7 lbs.

Iron of the same quality, but heated to dull redness the tenacity was - - 11,445.3 lbs.

So that the tenacity of this latter is but little more than one-sixth of that of cold iron‡ of the same quality.

* The thickness given by formula $(a,)$ corresponds to the only case which it is of importance to consider, viz. that in which the plane of rupture passes through the axis of the boiler. If we suppose the plane of rupture perpendicular to the axis, the case would refer itself to that of a spherical boiler, the thickness of which should, at most, be but one-half that of a cylindric boiler of the same diameter.

† These experiments were made by Messrs. Tremery and Poirier Saint-Brice.

‡ M. Cagniard-Latour was good enough to assist in these two experiments,

2nd. *Rolled Iron.*--Two experiments were made upon rolled iron of the best quality. The first gave for the tenacity of the rolled iron, - - - - - 58892.5
The second, - - - - 56554.6

Total, - - - - 115447.1
Mean, - - - - - 57723.5

3d. *Copper*—Sheet copper of excellent quality was submitted to experiment, its tenacity proved to be, - - 38,217.6

It is usually supposed that the tenacity of copper is about two-thirds that of rolled iron, $38217.6 \times \frac{3}{2} = 57326.4$ upon this supposition, a number not much less than that obtained by the experiments, just given, upon rolled iron.

Now if in the formula (c) we substitute for p, its value 15, it becomes $t = \frac{d \times 15\,(n-1)\,4.5}{c} = \frac{67.5}{c} \times d\,(n-1) \; . \; . \; . \; . \; . \; (d)$

It would seem that nothing remains but to substitute for c its value, in order to obtain that of the coefficient $\frac{67.5}{c}$. The remarks which follow will show that such is not the case, and that this coefficient must be determined by considerations of a practical kind.

The number given as that usually taken for the tenacity of rolled iron, viz. 44,000 lbs., would seem, from the experiments given, to be quite small enough. In practice, it is out of the question to take so high a tenacity as the basis of calculation.

In fact if we should make $c = 44{,}000$ in the formula for the thickness, we should have at low pressures, and with small diameters, thicknesses much too small, and the thicknesses would be rather small even for high pressures and large diameters. If we should diminish the value of c in order to have thicknesses which would suit the former of the supposed cases, we should obtain for the high pressures and considerable diameters, such extravagant thicknesses, that they could not be adopted in practice.

The difficulty arises from this, that in the formula reference is had to the force tending to burst the boiler which depends upon the tension of the steam within, that is, upon the value of n. In proportion as n is diminished, t diminishes also, and when $n = 1$, $t = 0$. This case is that of a boiler containing steam of atmospheric tension. Such a boiler is, of course, impossible.

In theory we may suppose sheets of iron to be diminished in thickness indefinitely; but such an idea is purely theoretical, and cannot be realized in practice. It is therefore necessary to set out with a certain thickness independent of the elasticity of the steam within

which were made at Clichy, in a laboratory where arrangements were making for the preparation of oil gas, for the purposes of illumination. The iron retorts in which the decomposition of the oil was to be effected were necessarily to be exposed to a dull red heat, and it was important to determine the tenacity of iron at the corresponding temperature.

the boiler, and also to add a thickness, which shall also be independent of the tension within, to make up for the loss of tenacity which the metal undergoes, in being bent, by the temperature to which it is exposed, and by wear. The least thickness which can be added to make up for these circumstances is .12 of an inch, ($\frac{1}{8}$th,) which must therefore be added to the thicknesses given by the formula.

We must now determine the value which $\frac{67.5}{c}$ should have in order that the thicknesses calculated by the formula and increased by .12 inch should suit all diameters of all tensions, and should agree, as nearly as possible, with the thicknesses usually given by the best manufacturers to their boilers, made to stand a long continued use.

It has been found that all these conditions may be satisfied by making $\frac{67.5}{c} = .0018$, which supposes for rolled iron a tenacity of 37,500 lbs. per square inch.

Substituting this value for the coefficient in formula (*d*,) and adding the constant thickness of .12 of an inch, we shall have

$$t = .0018\, d\, (n-1) + .12 \; . \; . \; . \; . \; . \; (e)$$

It has been remarked above, that the tenacity of the best rolled copper proved to be 38,217.6 lbs.; this number is rather higher than that, (37,500,) deduced from the coefficient .0018 of the formula (*e*,) this formula, therefore, may be used to determine the thicknesses of copper boilers, a condition which it was important to fulfil, since, for the reasons set forth in the instructions, manufacturers usually give no greater thicknesses to copper than to iron boilers. As, however, the number 37,500 is but little less than that given by experiment for the best varieties of copper, and as the tenacity of certain varieties may be lower than this, it will be necessary, according to the quality of the copper, to increase the thickness given by the formula, by about one or two-tenths of the thickness found.*

It results from the remarks contained in this note that for different values of *d* and *n*, the formula (*e*) will give the thicknesses, by the comparison of which in any given case with the actual thickness of a boiler, it may be ascertained whether, or not, this boiler can withstand the required proof without injury. Manufacturers by governing themselves by these thicknesses will not throw into use boilers incapable of bearing proof, after long continued wear. In this way they will be preserved from the ill effects which would result, if their boilers were condemned, by the engineers, in the annual visits of inspection required by the 7th article of the ordinance of October 29th, 1823. T.

* According to George Rennie, the tenacity of hammered copper is but 36.531.6 lbs. per square inch.

On the First Invention of Telescopes, &c.—By Dr. G. Moll, *of Utrecht.*

(Concluded from page 336, vol. 7.)

Having heard what was adduced on the side of Lippershey, we must now turn to the witnesses of Zacharias Tausz, of Taussen.

The first of these is the ambassador Boreel himself, a man alike respectable for his rank, character, and abilities. He says, that in 1591, the year in which he, (Boreel,) was born, a spectacle-maker lived near his father's house at Middleburg; that this man's name was Hans, his wife's Maria, and that, besides two daughters, he had a son called Zacharias; that Boreel knew this Zacharias intimately, they having been playmates. This Hans, *i. e.* John, with his son Zacharias, as *Boreel often heard*, invented the first *microscope*, which was presented to Prince Maurice, and they obtained some reward. A similar *microscope* was afterwards offered by them to the Archduke Albert of Austria. When Boreel was ambassador in England in 1619, he saw that identical microscope there, in the possession of Cornelius Drebbel, of Alkmar, a man of much knowledge, and mathematician to King James, the Archduke having presented the microscope to Drebbel. This microscope of Zacharias was not, continues Boreel, as they are shown at present, with a short tube; but it was about eighteen inches long, and two inches in diameter, with a tube of gilt copper, resting on two sculptured dolphins; under it was a disc of ebony, on which the objects to be examined were placed.* But long after, in 1610, by dint of research, they, (*i. e.* Hans and Zacharias,) invented in Middleburg the long sidereal telescopes, with which we gaze at the moon, the planets, stars, and heavenly bodies, of which a specimen was given to Prince Maurice, who kept it secret, judging it useful in expeditions. However, as this admirable invention was rumoured about, and as curious men were talking about it in Holland and elsewhere, a stranger came from Holland to Middleburg to inquire into this matter, and, asking for a spectacle-maker, he was shown, by mistake, into the shop of John Laprey. He spoke with him about the secret of the telescope. Laprey, being an ingenious man, and a close observer, heard attentively what the stranger said, and thus, with laudable industry and care, became the second inventor of the long telescope, which he made to the satisfaction of the stranger. Therefore Laprey, who by his ingenuity discovered a thing which was not shown to him, deserves to be ranked as second inventor. He first sold telescopes, and made them generally known. Afterwards, Adrian Metius, Professor of Francker, and, later, Cornelius Drebbel, came to Middleburg in 1620, and bought each a telescope, not from Laprey, but from Zacharias Tausz.

From this evidence we may infer, that Hans, or John, and his son Zacharias, were actually the inventors of a compound microscope for opaque objects: the elegant ornaments of this instrument, and

* A stage.

the general description which Boreel gives of it, make it probable that both Hans and Zacharias were men of ability. But with microscopes we have at present nothing to do. The point at issue is, whether either Hans or Zacharias, or any body else, actually made telescopes before the second of October, 1608; and since Boreel indicates 1610 as the epoch of the invention of Hans and Zacharias, the claim of Lippershey to priority remains unshaken, even by the evidence of Boreel.

The following witness is John, the son of Zacharias, and consequently grandson of this Hans, of whom Boreel has spoken. He says, in 1655, that he then was fifty-two years old; thus, at the period when Lippershey sent in his petition, *i. e.* in 1608, he was only five years old. He does not mention his grandfather, but says, that his father, Zacharias, was the first inventor of the telescopes; and that this happened, as he *had often heard*, in this town, in 1590; but the longest telescope made at that time did not exceed in length fifteen or sixteen inches. He affirms that two such telescopes were *then* offered, one to Prince Maurice, the other to the Archduke Albert; and that telescopes of such length were in use till 1618. At that time, he, John, and his father, Zacharias, invented the construction and fabric of the longer telescopes, which are still now used at night to look at the moon and stars. He further says that, in 1620, a man of the name of Metius came to Middleburg, and procured such a telescope, the construction of which he afterwards tried to imitate; and he adds, that Drebbel did the same.

This witness, fixing the epoch of the invention at 1590, speaks only from hearsay. Besides, he is in contradiction with Boreel, who states that the invention of the telescope by Hans and Zacharias was in 1610, at which time Boreel was nineteen, and this John Zacharias only seven years of age. John says nothing of the microscope, which Boreel actually saw and described. It is certainly possible that one of the Metii, perhaps the Professor, came to Middleburg in 1620, and bought a telescope. But this does not decide the question of priority, as we know, from incontrovertible authority, that Jacob Metius was in possession of the invention in 1608. What happened in 1620, when so many splendid discoveries were made by means of the telescope, is not of the least consequence, as far as concerns the first invention of the instrument.

There still remains another witness, whose evidence is very immaterial and of little importance. It is a woman called Sarah Goedard; she is a sister of Zacharias Jansz: she merely says, that it is forty-two or forty-four years ago since her brother invented the long telescopes in Middleburg. She often saw her brother at work making telescopes; but she cannot speak positively as to time.

This woman's evidence, who brings the invention to 1611 or 1613, cannot be of the slightest use in settling the question between Zacharias and Lippershey.

It was then the soldier of Sedan, who first brought the instrument to France; but his endeavours met with no great success in that country. It is most astonishing to find the French philosopher Pei-

rese doubting the truth of the invention of telescopes at late as 1622, and ascribing it to Drebbel, a person wholly unconnected with it. In a letter to William Camden, he says, "I should like to know what is true about the inventions of Cornelius Drubelsius Alkmariensis, who, as is said, has invented in your parts a globe representing ebb and flood, a covered boat going between two waters, and long *spy-glasses, (lunettes,) with which a writing may be read at the distance of a league, which we do not easily believe here.*"*

And in another place† he says, "we are told marvellous things here about the invention of Cornelius Drubelsius Alkmariensis, who is in the service of the king of Great Britain, and who lives in a house near London; amongst others a covered boat, which goes between two waters; a glass globe, which he makes to represent the tides, by a perpetual motion, regulated like the natural tides of the sea, *and of a spy-glass which makes one read a writing at more than a league*, (or a mile,) *distance.* I beg you to write me a word about the truth of each of these inventions. We have here those small glasses, (lunettes,) by which insects and mites appear as large as flies, which is certainly admirable; but I should like to know what is true respecting these other inventions."

It would appear that the invention was attributed by some persons to the soldier of Sedan, whose name appears to have been Crepi.‡ He left, as we have seen, the Low Countries in December, 1608, and in May following, 1609, we find a Frenchman in Milan making telescopes. Sirturus§ gives us the following account of this transaction.

"A Frenchman hurried to Milan in May, 1609, who offered a telescope to the Count de Fuentes. He called himself a partner of the Dutch inventor. The Count gave the instrument to a silversmith, to have it included in a silver tube; it fell into the hands of Sirturus, who handled and examined it, and made a similar one, (if his assertion is to be believed;) but perceiving that much depended on the glass, he went to Venice to get some at the workmen."

Simon Marius, who disputed the discovery of the satellites of Jupiter with Galileo, speaks of another Dutch telescope, which came into foreign parts at a very early stage of the invention. He says that in 1608, at the autumnal Franckfort mass, or fair, (usually held in September,) a certain General Fuchs de Bimbach, an amateur of mathematics, heard from a Dutchman then at the fair, that an instrument had been invented which magnified objects and made them appear near. He wanted to procure one of these glasses, but the Dutchman asked too high a price; but being returned to Onoldsbach, Fuchs told the circumstance to Marius; adding that the instrument had two glasses, one convex and one concave, of which he even drew the figures. Marius adjusted glasses of this form, and convinced himself, to a certain point of the possibility of the thing; but his ob-

* Gul. Camdenii et ill. viror. ad Camden. Epistol. London, 1691, p. 333.
† Page 387.
‡ Borel de verotelescopii inventore, p. 19.
§ Sirturus de telescopie, Edit. Frankf. 1618. 4to. minori, p. 25.

ject glass was too convex. He ordered some other glasses of the opticians of Nuremberg; but he could procure none that suited his purpose. The next summer, of 1609, Fuchs got a tolerable instrument from Holland, which he used with Marius in examining the heavens. About the beginning of 1610, Fuchs got two well polished glasses from Venice, where they had been worked by T. B. Lanccius, recently returned from Holland.

If the account of Marius deserves credit, the person who brought the telescope to the Franckfort mass, or fair, in September, 1608, did so a short time before Lippershey presented his petition to the States, which was done the 2nd of October of that year. Fuchs, certainly with great reason, thought the Dutch telescopes high priced; we have seen Lippershey asking a thousand florins for one.

We are indebted to the English author of the *Life of Galileo* for an instance of another Dutch telescope being brought to Italy. Lorenzo Pignoria writes to Paolo Gauldo, from Padrea, the 31st of August, 1609, "We have no news, except the return of his Serene Highness, and the re-election of the lecturers, among whom Signor Galileo has contrived to get 1000 florins for life, and it is said to be on account of an eye-glass, like the one which *was sent from Flanders to the Cardinal Borghese.* We have seen some here and they succeed well."

It will, after all, be very difficult to deny, that not only the rumour of the invention, but even some telescopes actually made, reached Italy from Holland, before Galileo ever made such an instrument. In May, 1609, there was a telescope in the hands of the Count de Fuentes. Another was in the possession of Cardinal Borghese; Lanccius, who came from Holland, is said to have made telescopic glasses at Venice; Fuccarius distinctly says, that one Dutch telescope was brought to Venice, and *that Galileo saw it.** But such is our respect for the genius and character of Galileo, that his mere assertion that he never saw a telescope when he set about making one; that he did not know its construction; that his friend Jacob Badorere, by whom he got intelligence of the invention from France, did not give him any information of the manner in which it was made—his simple assertion of all this is taken by us as conclusive against any presumption.

Nelli, in his *Life of Galileo*, says that the Florentine philosopher first heard of the invention in June, 1609. Galileo himself informs us, in a letter written in March, 1610, that he heard of the invention about ten months ago, which would fix the time of his first attempt to the month of May, 1609, the time when, we know from Sirturus, that a Frenchman brought a telescope to Milan.

Even after the very able manner in which the history of Galileo's discoveries have been recently given by an English author, it will not be superfluous to give Galileo's own account of the transaction. In March, 1610,† he wrote in the following manner:—"It is about

* Kepleri. epistolæ, No. 309, p. 493. † Epist. 4. Td. Martii, 1610.

ten months ago that it came to our ears, that a glass* had been worked by a Belgian, by the help of which, visible objects, though at great distance from the eye of the observer, may be seen distinctly. (In the Italian of the saggiatore it is added *ne piu aggiunto*, *no more was added*, or *this was all.*) And some experiments were related of the admirable effects of this instrument, which some believed, and others not. A few days afterwards the same was confirmed by letters of a noble Frenchman, Jacob de Badorere, from Paris; all which occasioned me to apply myself wholly to inquire into the cause of this, and to think on the means by which the invention of a similar instrument might be brought about; in which I succeeded in a short time, assisted by the doctrine of refraction: and I first procured a leaden tube, at the end of which I adapted spectacle glasses,† both plane on one side, the one convex on the other side, the second concave. Bringing the eye near the concave glass, I saw the objects large, and near enough: they appeared three times nearer, and nine times larger, than if seen with the naked eye.

"Afterwards I made another instrument, which made objects appear sixty times larger.

"Finally, sparing neither industry nor expense, I succeeded so far as to make an instrument of such excellence, as to make the objects seen through it, appear a thousand times larger, and more than thirty times nearer, than if seen with the natural power of the eye."

Viviani, Galileo's favourite pupil and friend,‡ says that in the month of April or May, 1609, it was rumoured in Venice, where Galileo then was, that a Dutchman presented to Count Maurice, of Nassau, a certain glass occhiale, with which distant objects appeared as if they were nearer, *nothing more was said.*§ With this information only Galileo returned immediately to Padua, to try whether he could find out the construction of this instrument, in which he succeeded on the following night. The next day was employed in constructing the instrument, in the manner which he had imagined; and, notwithstanding the imperfection of the glasses which he procured, he saw the effects which he anticipated, and immediately gave notice of it to his friends in Venice. He constructed, after this, instruments of better quality; and six days later he took some of them to some elevated part of the city, and made the first senators of the republic observe distant objects, which they did with great admiration. Bringing constantly the instrument to greater perfection, he resolved finally, with his wonted liberality, to communicate his invention, and to make a free gift of it to the serene Prince and Doge Leonardo Donati, and to the Senate of Venice, presenting with the instrument a paper, in which he declares the construction, and the admirable use and results on *land and on sea*, which might be obtained from this invention. In consequence of this noble present, the serene republic, with generous demonstration of the 25th of August, 1609, wrote to Galileo, and a pension was granted him for life,

* Un occhiale, perspicillum.

† Vitrea perspicilla.

‡ Viviani vita del Galileo, p. 69.

§ *Ne piu oltri fu detto.*

with more than three times the salary, which it was the custom to give to a lecturer of mathematics.

Thus we perceive the Venetian Senators doing in August, 1609, the same thing which the members of the states-general had done in October, 1608, about ten months sooner. They ascended to high places for the purpose of gazing at distant objects. Both the Dutch and the Venetian magistrates nobly rewarded the invention, which was tendered to them. The Venetians rewarded Galileo as a philosopher should be rewarded, by an honourable station and independence. The Dutch treated Lippershey in the best way an artist can be treated; they gave a high price for his article, and made large orders for it. The date assigned by Viviani to these transactions, the 25th of August, 1609, agrees completely with what Lorenzo Pignoria wrote the 31st of August to Paolo Gualdo, and which letter was mentioned above.

It is exceedingly gratifying to observe, that Galileo almost immediately brought the telescope with a convex object-glass and a concave eye-glass, to all the perfections of which it is susceptible, without being achromatic. He observed with it all that could be seen by its means; he ascertained the power of his glass with great ingenuity, and he indicates the difference between linear and superficial amplification with perfect accuracy. His German biographer Tagemann, does not seem to have clearly understood this difference, for he appears to imagine that Galileo's telescope really had a power of 1000 times, whereas it was only of about 32.

In a Galileon telescope the focal length of the object-glass cannot go beyond a certain extent, without narrowing the field too much. The eye-glass cannot be made very deep without making it too thin in the centre. Even at present it would, perhaps, be difficult to make Galileon telescopes of greater power than 32, which is, indeed, that which Galileo obtained.

On the 7th of January, 1610, Galileo discovered three of the satellites of Jupiter; on the 13th, the four satellites were observed and recognised as satellites; but it is not my object to enter into that splendid train of discoveries which illustrated the name of Galileo, and which lately have been so well described. However perfect we allow the instruments of Galileo to have been, we see no reason to doubt that the satellites could be seen with the instruments made in Holland. The Italian authors certainly assure us that the Dutch telescopes were of an inferior description; but this assertion is wholly unsupported by proof. Indeed we know nothing of these telescopes except that they were long, (*tubi longi,*) and longer than 16 inches;* and it is not unrational to suppose, that with this length, they were equal to Galileo's telescopes. Admitting the length of the telescope to have been sixteen inches, and the negative focus of the concave eye-glass half an inch, the power of the telescope was 32, or equal to that of Galileo. The Professor Adrian Metius,† brother of the

* De vero telescopii inventore, p. 30.

† Adriani Metti, Institut. Astronom. et Geograph. Francq. 1614. Fondamentale en grondelyche ouderuysinge, ibid 1614. Adriani Metii tractatus de genuino usn utrusque globi, Francq. 1624. 4to.

co-inventor of the telescope, gives us some account of what could be seen with the telescopes then made in Holland. In a book printed in 1614, he says, "During the day several planets are observed near the sun, which were unknown hitherto to all men, but which can only be seen with the glasses, which my brother, Jacob Adriaansz, invented six years ago, (thus in 1608.) These planets show themselves first in the eastern part of the sun, and from thence pass over the sun to the westward, in about ten days, as I observed several times, principally about sunrise and sunset.

"With these same tubes some erratic stars or planets are seen, which have their course round Jupiter; but of these nothing can be stated with certainty, unless my brother be pleased to publish his telescopes, by means of which many strange things will be brought to light, as well about the moon as elsewhere. Yea, the observations of the stars may then be made with much greater accuracy; because, by means of these telescopes, it will not only be possible to observe minutes, but even seconds."

It does not appear from this quotation that the professor himself observed the satellites; nor does he even appear to be aware of their number. His brother Jacob, perhaps, gave him some incomplete information of the existence of the satellites. But *he saw* the spots of the sun, which may be seen with instruments of a less power; and he labours under the erroneous notion then common to many, that the spots were planets or satellites revolving round the sun.

But what the Professor says of *the accuracy* which the invention of the telescope is likely to insure to astronomical observations, is very remarkable. What does he mean by asserting, *that the observations on the stars will become accurate to a second?* Did the pupil of Tycho anticipate the application of the telescope to instruments of mensuration; to quadrants? I must own that it is difficult to take his distinct words in any other sense; and I am led to believe, that the idea of an invention, which did so much credit to Gascoigne, had occurred to Adrian Metius.

There is a passage in the English Life of Galileo, which ought not to pass unnoticed. The anonymous author accuses William Boreel, to whom he chooses to give the Italian name of Borelli, of glaring partiality against Galileo. "Borelli," says this author, "not satisfied with attributing the invention of telescopes to Zanssen, endeavours to secure for him and for his son the more solid reputation of having anticipated Galileo in the useful employment of the invention. He has, however, inserted in his collection a letter from John, the son of Zacharias, in which John, omitting all mention of his father, speaks of his own observations of the satellites of Jupiter, evidently seeking to insinuate that they were earlier than Galileo's; and in this sense the letter has been since quoted, although it appears from John's own deposition, preserved in the same collection, that, at the time of the discovery, he could be no older than six years. An oversight of this sort throws doubt on the whole of the pretended observations; and, indeed, the letter has much the air of being the production of a person imperfectly informed on the subject on which he

writes, and probably was compiled to suit Borelli's purposes, which were to make Galileo's share in the invention appear as small as possible."

I crave the liberty of replying to this passage, that if probabilities are to be introduced in the case, it seems extremely probable that the learned author of the Life of Galileo has never read Borel's book with sufficient attention, and, as the book is scarce, he knows it perhaps only from quotation. There is *no letter* inserted in it from John, the son of Zacharias; but in answer to some queries either from Boreel or from Borel, he gives two memorials or notes of what a telescope of his making could show. In the first place, he mentions the appearances and dark places in the moon; and it is to be observed, that what he says of the appearance of the moon seen through his telescope, answers exactly to what one would expect of a good instrument. It plainly shows, says John, the moon to be a sphere, with distinct edges, and not a plane. The following is his statement of Jupiter's satellites: he often observed the planet which shows itself round, well defined and spheric; near it he often saw two highly situated small stars, sometimes he saw three, and generally four of these small stars. As far as he could observe, they go perpetually in circles round Jupiter; but, he adds, this I leave to astronomers to determine, for it is not, says he, my business to make astronomical observations, but to furnish astronomers with telescopes as good as I am able to make.

I challenge the author of the Life of Galileo to point out the passage in Borel's book in which either Boreel, or John, the optician, exhibit the least intention of throwing Galileo's discoveries in the shade. But it may be permitted, I should think, to an optician, when asked by an ambassador at a foreign court, to state what the performances of his instrument is; and I believe that neither Mr. Dollond nor Mr. Tully could be justly accused of disparaging Sir William Herschel's merit, if they were to state that the Georgium Sidus is visible in their telescopes. John certainly says, in 1655, when he was fifty-two years of age, that he often saw four satellites with a telescope of his own making; but he never says that he saw the satellites before January, 1610, the epoch of Galileo's discovery, nor does he even mention *when* he first saw them. He is, he says, no astronomer, but an optician; and when this optician states, in 1655, that he makes telescopes with which the satellites can be seen, it is difficult to understand how it can be inferred that he made this statement in order to deprive Galileo of the honour of discovering the satellites in 1610. Thousands, certainly hundreds, saw the satellites in 1655; and why should not John, like other people? I, therefore, positively deny that any intention is shown in Borel's book, to depreciate the merits of Galileo; and as far as Boreel is concerned, considering his character and station in life, it is absurd to say, *that his evident object* was to make Galileo's share in the invention as small as possible; but if Boreel really undervalued Galileo's merits, let the English author quote, and point out the place *where* he did so. I must offer another remark on this same anonymous au-

thor. I am quite prepared to believe that the telescopes made by Galileo's own hands were as perfect as art could make them at the time; but it is to be lamented, if the original telescope of Galileo still exists in Florence, that no Italian philosopher has favoured us with an account of its performance. We have, however, a sort of criterion of what could be done by it. The belts of Jupiter were, as far as I know, never seen by Galileo; they were observed, after his death, or blindness, with instruments made by Evangelista Torricelli. But the author of the English Life of Galileo asserts, as proof of the inferiority of the Dutch telescopes, that in 1637, *Gaertner, or as he chose to call himself Hortensius*, wrote to Galileo, that no telescope could be procured in Holland, sufficiently good to show Jupiter's disk, well defined."* Hortensius wanted more than could be accomplished in his time; and even now, telescopes of a certain size, which show Jupiter's disk well defined, are not of every day's occurrence. Does this author know many telescopes excepting those made by Mr. Dollond or by Mr. Tully, capable of showing Jupiter's disk, *well defined;* nay, does he know one single telescope, *not achromatic*, capable of answering the claim of Hortensius. The anonymous author favours his readers with a translation of Hortensius name, which he pronounces to be *Gaertner*. He is mistaken, however: Gaertner certainly is the *German* of Hortensius; but he was *not* a German, and his name, in his mother tongue, was Van den Hore.

We find the celebrated Peirese, as late as 1622, doubting the invention of telescopes: in England, these instruments were known at a much earlier period. The celebrated English mathematician, Thomas Harriot,† actually observed the satellites of Jupiter, as early as the 10th of January, 1610, which is only *eleven days* later than Galileo's discovery. It is, indeed, astonishing, that an *English author* should overlook this circumstance. Harriot also observed the spots in the sun for the first time, on the 8th of December, 1610. They were first seen by Galileo in November of the same year. Harriot's telescopes had, it appears, powers of 10, 20, and 30. His observations run from the 16th of January, 1610, to the 26th of February, 1612; he gives drawings of the configurations and computations of their revolutions. Now, it may be asked, from whence did Harriot get the telescope with which he observed the satellites only a few days later than Galileo? Certainly not from Italy; he either made it himself, or got it from Holland.

But a few months later we find another English astronomer furnished with a telescope. Sir Christopher Heydon writes, on the 6th of July, 1610, to the well known William Camden:—"I have read Galileo, and, to be short, do concur with him in opinion; for his reasons are demonstrative; and of my own experience, with *one of your*

* Page 25.

† These observations and other manuscripts of Harriot, were discovered in 1784, by Baron de Zache, at Petrowth, in Surry, the seat of Lord Egremont. See Bode's Astronom. Tahrbuch, 1788, p. 155, Monatliche Correspondenz, t. viii. p. 144.

ordinary trunks, I have told eleven stars in the Pleiads; whereas no age ever remembers above seven; and one of these, as Virgil testifieth, not always to be seen.*

Telescopes were then, it appears, called *trunks*. Harriot, in his letters to Henry Percy, Earl of Northumberland, calls them *perspective cylinders*. It appears that the Earl possessed many of them, and that he wanted some more. It is to be lamented that Harriot's papers and manuscripts are at present buried in one of the libraries of the University of Oxford.

From all which has been said in this paper, the following facts may be established, as proved by authentic documents:—

That on the 2nd of October, 1608, John, or Hans Lippershey, a native of Wezel, a spectacle-maker of Middleburg, in Zealand, was actually in the possession of the invention of telescopes.

That, on the 17th of October, of the same year, 1608, Jacob Adriaansz, sometimes called Metius of Alkmar, in Holland, also was in possession of the art of making telescopes, and that he actually made those instruments; but that either from disgust, or some other reason, he afterwards concealed his invention, and thus actually gave up every claim attached to the honour of it.

That there is little reason to believe that either Hans, or his son, Zacharias Zansz, were also inventors of the telescope; but there is every probability that this Hans, or John, or his son Zacharias Zansz, invented a compound microscope about 1590.

That this Lippershey used rock or mountain crystal in the construction of telescopes, and that he is the inventor of the Cinoculus.

[*Jour. Royal Institution.*

On substituting Plates of Fusible Metal for Wood Blocks in Calico Printing, &c.—By M. G. Engelmann.†

The engraving of wood blocks for calico printing is very expensive, and these blocks being also formed of an hygrometric substance, are continually subject to change from swelling and shrinking by the effects of moisture and dryness, and thus occasion a considerable loss of time; and give false impressions from the trouble of replacing them, and the consequent inequality in their adjustments. I have therefore endeavoured to substitute for them a substance which is not liable to swell by the action of humidity; can be moulded with great accuracy, and at the same time is capable of resisting the effects of the blows of the mallet, and of the acids contained in certain of the colours used in calico printing. The fusible alloy appears to me to offer these advantages, and I employ the *en cliché* process in its application.

I operate in the following manner:—Having made an engraving in wood on a piece of plank, and given a sufficient breadth to the

* Gulielmi Camdeni et illust. viror. ad G. Camden. Epistol. London, 1691, p. 128.

† From Bullet. de la Soc. Indust. de Muhlhausen; and Feurressac's Bulletin des Sciences Technologiques.

bottom of the lines to enable the cast to part from the mould, I interpose between the metal and the wood a substance which shall facilitate their separation; to effect this, I brush over the engraving a mixture of ground *sanguine*, (red chalk,) and water. I then finally affix the engraved block to the bottom of the upright slide or stem of the stamp, and let it fall suddenly upon the melted fusible alloy at the moment when it is just upon the point of becoming solid, or has acquired a *pasty* consistence, I thus obtain a counter proof of the engraving. This counter proof serves as a matrix or mould for the engraved plates of fusible metal which I intend to make. For this purpose I affix it to a piece of wood, and surround it with a border of metal, intended to determine the thickness of the metal plates struck in it, and which border is also formed in such a manner, as that whether placed on one side or the other it shall exactly fit; I then firmly affix this matrix, thus surrounded with its frame, upon the bottom of the stem of the stamp, and strike another counter proof *en cliché*, and so proceed until I have thus produced enough of them to compose and to cover a calico printing block.

These second counter proofs thus obtained, I place, with their engraved faces undermost, the one by the side of the other, upon a flat surface, and also shape and dispose them with the necessary regularity to insure precision in the impressions from them; I then pass a heated iron along the joints in order to solder one piece to another, and then fix the whole upon a wooden plank by means of copper nails, but I previously varnish the plank to prevent moisture from penetrating it. These blocks, if I may judge from the two experiments which I have made with them, offer no other inconvenience than being a little heavier than those made entirely with wood; they differ, however, but little from those blocks in which the raised parts are made with brass or copper,—a difference trifling in comparison with the great advantages they possess in not being liable to change from the action of moisture.

It is easy to see that a calico printing-block thus constructed must cost much less than one engraved upon wood, and especially as we need only to engrave a segment, or one of the parts, which are usually repeated a great number of times; and to multiply them by the *clichage*, an operation which will produce in less than an hour more casts than are sufficient to fill a block thickly covered with them. The value of the metal employed, and which need not be more than a line in thickness, is a mere trifle, and after the block has done its work may be remelted. We can preserve the small matrices which occupy but little room, and when we require to make another block it can be done quickly. It is also equally easy, in changing a moulded pattern, to vary the position of these small casts, since we can either bring them near together, or remove them to a distance apart; place them in a line, or mingle one piece with another, and thus either form them into borders, or employ them in the interior parts of the prints.

If we compare the price of these blocks, with those whose raised parts are formed of brass or copper, it is greatly in their favour; and we have no doubt that in the hands of skilful persons, the art of form-

ing them by means of *clichage*, will obtain as great perfection as those blocks possess. [*Repertory of Inventions.*

Mordant for Calico-Printers.—By Mr. Francis Davis, *of Cold Bath Square.*

From the Transactions of the Society of Arts.

Mr. Faraday has already noticed, in a periodical publication, the property which solutions of the salts of uranium possess, even with a superabundance of acid, of producing a red stain on turmeric test-paper, similar to that which is produced on the same paper by solutions of the alkalies. By pursuing Mr. Faraday's inquiries further than it appears that he himself carried them, I found that solutions of the salts of this metal give a reddish brown colour to paper made yellow by French berries, fustic, quercitron bark, and weld, as well as to paper impregnated with infusion of nut-galls. This suggested to me the possibility of adding to the mordants at present in use, one, which, when printed on calico, &c. would give, with the above-mentioned drugs, by means of the same copper of dye, an additional colour, and thus add a considerable variety to patterns of cotton-prints, without the trouble employed in dying them being at all increased.

The mordants at present in use, and the only ones, I believe, ever used in cotton-spinning, are alumina and the buff or deutoxide of iron. These are applied to the cloth, united with acetic acid, but are not fixed in it upon the same principle.

Acetate of alumina is of such a nature that, when its solution receives a high temperature, say about 212° Faht. part of the alumina is deposited. Being laid on cold, the cloth is afterwards passed round heated tubes, and thus alumina is deposited in intimate union with the fibre of the cotton, &c.

The case is somewhat different with respect to the iron mordant. The iron liquor, or solution of acetate of iron, contains this metal in the state of a protoxide, which is very soluble in acetic acid; and if, in this state, it be exposed to the atmosphere, a larger portion of oxygen is acquired, and the deutoxide of iron which is then formed being less soluble, precipitates. After the iron mordant has been applied to the cloth, it is necessarily exposed to the atmosphere, and consequently the oxide of iron is precipitated and fixed in it.

The oxide must be fixed in the cloth, that the latter may, before being put into the dye-bath, go through the cleansing processes to which the manufacturer is obliged to subject it after application of the mordant.

The oxide of uranium, before it can be applied as a mordant, must also be intimately combined with the fibre of the cotton, as I have shown to be the case with the others. I found that the acetate of uranium possessed neither the property of the acetate of alumina, nor of that of iron, and was in all respects unfit for the purpose required. It therefore became necessary to search for some liquid combination of uranium, which should resemble, in its mode of ac-

tion, one or other of those salts. As the three following solutions all possess the property of acetate of alumina, they appear to me to be well adapted to obtain the end proposed.

The yellow oxide of uranium (called by some the peroxide) is soluble with heat, in a solution of

The sub-carbonate of ammonia;
The bi-carbonate of soda; and
The bi-carbonate of potass.

To one or other of the above solutions, saturated with oxide of uranium, and become *cold*, add strong acetic acid in sufficient quantity to saturate the ammonia, soda, or potass employed; as, for example, to prepare the one in which the carbonate of soda is used, dissolve two parts by weight of this salt in sixteen parts by weight of water; this solution, boiled in one part by weight of oxide of uranium in powder, will dissolve it: when cold, add five parts, also by weight; of strong purified wood vinegar of commerce; agitate the mixture. The quantity of acetic acid added must of course depend upon its strength.

When the acid is added to the solution of the oxide, in any one of the above-mentioned salts, the transparency of the solution is not disturbed, nor is any of the oxide of uranium deposited; but if it be made to boil, it will exhibit the same property as a solution of the acetate of alumina, by becoming turbid; and if the ebullition be continued for a short time, the whole of the oxide of uranium will be precipitated, leaving, when the oxide has had time to settle, a colourless, supernatant liquor. This liquor being entirely colourless, may be considered as a criterion of the acid having been added in proper proportion to the other ingredients; for the liquor will retain a yellow colour, if the acid be added in too great or in too small a quantity.

Any one of these solutions, thus prepared, when mixed up with gum, and laid by a pencil on cloth, and this afterwards passed through the same heating process as that used for it when prepared with acetate of alumina, will be found to deposit the oxide so firmly in the fibre of the cotton, &c. as to qualify it to bear any cleansing to which the calico-printer may find it necessary to subject it. With respect to which of these solutions may be best adapted for this purpose, I think it likely that the one made with the sub-carbonate of ammonia will be found preferable; but as in this communication I intend to confine myself to that of which my experiments qualify me to treat, so I feel diffident in pronouncing positively upon the relative merits of these solutions, because, when used by me, they were only pencilled upon the cloth, instead of being impressed by the block of the calico-printer.

An obvious way of precipitating the oxide in the cloth must suggest itself to any person acquainted with the nature of metallic salts; namely, by printing the cloth with any of the soluble salts of this metal, and then dipping it into a solution of an alkali, or lime-water. There are many very serious objections to this mode of effecting the end proposed. I shall confine myself to stating two: first, it would

be introducing an additional manipulation—an inconvenience which will be avoided by the use of the solution of the oxide in the alkaline carbonates above proposed; secondly, when a piece of cloth, treated by me in this way, was passed through a dye-stuff, it was found to have received the colouring matter very unevenly, and exhibited a fainter colour than that imparted by the same dye-stuff to places mordanted by the solutions of the oxide in the carbonates, although a greater quantity of oxide was, to all appearance, fixed in the cloth by treatment with the alkali than by the other way. In this manner, indeed, a very permanent bright yellow colour, a circumstance which ought not to be lost sight of by the manufacturer, may be produced in cloth, without its undergoing any other preparation.

With Nutgalls.

In infusion of nutgalls solutions of the salts of uranium occasion a brown precipitate: it was therefore to be anticipated that the colour given by this dye to the uranium mordant would be the same. The colour received is, in fact, a dull brown. This appears to be as permanent as the black produced by iron, and stands washing as well. When used in conjunction with the iron mordant, colours having all the varieties that can be formed from these two may thus be produced in the same bath of dye. To ascertain whether the brown colour of the uranium mordant was produced by the same principle (generally considered as the gallic acid) which produces black with the iron, a piece of calico, previously dyed brown by uranium and galls, after being thoroughly washed, was boiled in a solution of muriate of iron, and, as might have been expected, was by these means changed to black.

With Weld and Quercitron Bark.

The colours obtained from these dying drugs resemble one another in every respect. They are yellow, brown, or faded-leaf colour: they appear as permanent in the sun's rays as the yellow that is given with alumina, and will stand washing. If uranium, alumina, and iron, be used together, a bright yellow, light brown, and dark olive green, as well as all the various combinations of these three colours, may be obtained by one bath of these dye-stuffs at the same time. This brown colour gave the same indications of the presence of gallic acid as the one from nutgalls, when treated with solution of muriate of iron.

With Fustic and French Berries.

But the most valuable property of the uranium mordant is, its producing, with the above articles, a very agreeable and permanent colour, varying from a light red to a chesnut colour. The colour from French berries approaches nearer to pink than that derived from fustic. It might be imagined that the gallic acid is concerned in producing these colours, as well as the ones obtained from weld and quercitron bark, as the infusion of both fustic and French berries will give a black precipitate with a solution of iron, in the same man-

ner as the infusion of weld or of quercitron bark; and they are also, as well as the two latter, capable of giving an olive-green colour with the iron mordant. But, notwithstanding those strong grounds for supposing that the colour produced by fustic and French berries is a compound of gallic acid and uranium, when tried by the test before mentioned, of boiling with a solution of iron, the colour was found to be very little, if at all, altered. The calico-printer will find, by the use of the uranium mordant, that he will be enabled to print a very permanent, and, as I think, a very desirable colour, by the use of either of these two drugs, which have only hitherto furnished fugitive yellows with alumina, the one from French berries being particularly worthless. If this colour may be said to change by being much washed, it is by becoming more red than at first.

Turmeric.

This dye is not capable of being fixed or rendered permanent in cloth either by this, or by any of the other mordants; and although, if the cloth be first dyed by turmeric, and then impregnated with a solution of a salt of uranium, it is changed to red, yet it returns to its original yellow colour with very little washing, indeed by merely holding it in a stream of running water.

Turkey berries, sumach, and valonea, are so similar in their properties to some of the drugs already noticed, that I have not considered it necessary to make any trial with them.

Annotta, when dissolved in an alkaline solution, the usual mode, I believe, of applying it, was not affected by uranium.

It was also tried along with the red dying drugs madder and cochineal, as also with logwood; but as no discovery, likely to be useful to the manufacturer, resulted from my experiments, I shall not trouble you with any remarks upon these dyes, further than by saying, that the colour imparted to it by madder, resembled that given by this drug to alumina, only of a considerable darker shade; and that received from cochineal was of a slate gray colour.

The oxide of uranium made use of by me was obtained from the pitch ore, or native sulphuret of that metal.—*Rep. of Inven.*

The Results of Machinery.

(Concluded from page 412, vol. 7.)

THE examples hitherto quoted have exhibited the progress of improvement in works of the hand merely—*manufactures*, properly so called; but it is further shown, that in the operations of the mind there has been the same constant striving after abridgment of labour, attended with the same beneficial results.

"To all of you who read this book it is no difficulty to count a hundred; and most of you know the relation which a hundred bears to a thousand, and a thousand to a million. Many of you are able, also, to read off those numbers, or parts of those numbers, when you see them marked down in figures. There are many uncivilized people

in the world who cannot count twenty. They have no idea whatever of numbers, beyond, perhaps as far as the number of their fingers, or their fingers and their toes. How have we obtained this great superiority over these poor savages? Because science has been at work, for many centuries, to diminish the amount of our mental labour, by teaching us the easiest modes of calculation. And how did we learn these modes? We learnt them from our schoolmasters."

* * * *

"When a boy has got hold of what we call the rudiments of learning, he has possessed himself of the most useful tools and machines which exist in the world. He has got the means of doing that with extreme ease, which, without these tools, is done only with extreme labour. He has earned the time which, if rightly employed, will elevate his mind, and therefore improve his condition."

* * * *

"The foot-rule of the carpenter not only gives him the standard of a foot measure, which he could not exactly ascertain by any experience or any mental process; but it is also a scale of the proportions of an inch or several inches, to a foot, and of the parts of an inch to an inch. What a quantity of calculations, and of dividing by compasses does this little instrument save the carpenter; besides ensuring a much greater degree of accuracy in all his operations! The common rules of arithmetic, which almost every boy in England now learns, are parts of a great invention for saving mental labour. The higher branches of mathematics, of which science arithmetic is a portion, are also inventions for saving labour, and for doing what could never be done without these inventions. There are instruments, and very curious ones, for lessening the labour of all arithmetical calculations; and tables—that is, the results of certain calculations, which are of practical use, are constructed for the same purpose. When you buy a joint of meat, you often see the butcher turn to a little book, before he tells you how much a certain number of pounds and ounces amounts to, at a certain price per pound. This book is his "Ready Reckoner," and a very useful book it is to him; for it enables him to despatch his customers in half the time that it would otherwise require, and thus to save himself a great deal of labour, and a great deal of inaccuracy. The inventions for saving mental labour, in calculations of arithmetic, have been carried so far, that Mr. Babbage, a gentleman whose name we have twice before mentioned, has invented a calculating machine, which not only does its work of calculation without the possibility of error, but absolutely arranges printing types of figures, in a frame, so that no error can be produced in copying the calculations, before they are printed. We mention this curious machine, to show how far science may go in diminishing mental labour, and ensuring accuracy."

* * * *

"The effects of saving unprofitable labour are the same in all cases. The use of machinery in aid of *bodily* labour has set that bodily labour to a thousand new employments; and has raised the cha-

racter of the employments, by transferring the lowest of the drudgery to wheel and pistons. The use of science in the assistance of *mental* labour has conducted that labour to infinitely more numerous fields of exertion; and has elevated all intellectual pursuits, by making their common processes the play of childhood, instead of the toil of manhood.

It can never be too strongly impressed on the public mind—perhaps it is not sufficiently so in the treatise before us—that wherever there is a saving of labour, whether in mental or bodily operations, there is uniformly a progression in improvement. Articles are made not only at less cost, but a great deal better; calculations and deductions not only quicker but more accurately. The cloth produced by machinery is of a more equal and durable texture than that made by hand; and a pin is a more perfect cylinder than any hand could produce of so small a size. The slate and pencil may err, even in the expertest hands; but tables, which have stood the test of ages, never. Could all the labour which the common multiplication table has saved mankind, and all the errors from which it has protected them, only be calculated, the mind could hardly fail to contemplate with amazement, the vast good of which even this very simple, but most ingenious contrivance, has been the source.

The absurdity of the prevailing prejudices against the use of machinery is still further illustrated by an analysis of some of the more recent cases of combination against it. In December last, a band of agricultural labourers, in the neighbourhood of Aylesbury, destroyed all the machinery of many farms, down even to the common drills; but they *could not make up their minds* as to the propriety of destroying a horse-churn, and therefore they passed it over. But—

"Why should the labourers of Aylesbury not destroy the harrows as well as the drills? Why leave a machine which separates the clods of the earth, and break one which puts seed into it? Why deliberate about a horse-churn, when they are resolved against a winnowing machine? The truth is, these poor men perceive, even in the midst of their excesses, the gross deception of the reasons which induced them to commit them. Their motive is a natural; and if lawfully expressed, a proper impatience under a condition which has certainly many hardships, and those hardships in great part produced by the want of profitable labour. But in imputing those hardships to machinery, they are at once embarrassed when they come to draw distinctions between one sort of machine and another. This embarrassment decidedly shows that there are fearful mistakes at the bottom of their furious hostility to machinery."

The gross ignorance in which the agricultural peasantry are so generally sunk, may serve to account for the folly of these Aylesbury men; but there have been other classes of operatives equally foolish, for whom no such apology can be offered. The prejudice against machinery has not been confined to peasants who can neither read nor write, but has been largely shared in by the (comparatively) well-educated and well-paid artizans of our cities and towns—by those even who are most intimately connected with the diffusion of

knowledge—who live by books, and are, or ought to be, better acquainted with the wisdom that is in books than any other workmen whatever. Last September the operative printers of London, following the example of their brethren of Paris, came to a series of resolutions deprecating in strong terms the employment of machinery in printing, unless subjected to a heavy tax. The merits of this proceeding were well discussed in a letter, which appeared at the time, ni the "Mechanics' Magazine" for October 9, 1830, and need not therefore be gone into again. From the journeymen printers the mania passed to the journeymen bookbinders of the metropolis, from whom a circular appeared about two months ago, calling upon their employers to give up the use of a machine for beating books.

'Books, before they were bound in leather, used to be beat with large hammers upon a stone, to make them solid. That work is now done in London by a machine. The workman is relieved from the only portion of his employ which was sheer drudgery—from the only portion of his employ which was so laborious that it rendered him unfit for the more delicate operations of bookbinding, which is altogether an art. The greatest blessing ever conferred upon bookbinders, as a body, was the invention of this machine. Why? It has set at liberty a quantity of mere labour without skill, to furnish wages to labourers with skill. The master bookbinders of London and Westminster state, that they cannot find good workmen in sufficient quantities to do the work which the consumer requires. The good workmen and the bad each were employed in the drudgery of beating, which called into action a certain muscular power of the arm and hand, which unfitted them for the delicacy and rapidity of other operations of bookbinding. The good workmen were therefore lessened by the drudgery of the beating-hammer: but the bad workmen, the mere labourers, whose work a very simple machine can do better, feel that they cannot compete with this machine. Why? They were indolent and dissipated, and the work which they neglected is now done without their aid. The great delay in bookbinding was always occasioned by the delay in beating. It was the mere drudgery which the better men paid others to perform; and these mere drudges, by the neglect of their work, kept the higher orders of bookbinders idle. And yet, in spite of their own experience, all the bookbinders try to put down the beating machine, which has a tendency, above all other things, to elevate their trade, and to make that an art which, in one division of it, was a mere labour.

"The objection of the bookbinders to the beating machine offers a remarkable example of the inconsistency of all such objections. The bookbinders have a machine called a plough, for cutting the edges of books, which is, probably, as old as the trade itself. A great deal of labour, and a great deal of material, are saved by this plough. Why do they not require that a book should be cut with a ruler and a pen-knife? They have presses, too, acting with a screw, to make the book solid and flat. A press with an iron screw will do ten times the work of a press with a wooden screw; and one of Bramah's hydraulic presses, which has power enough, if fully exerted, to break

a piece of wrought iron three inches thick, will do twenty times the work of the common iron screw press. Nobody insists that the master bookbinder shall use the press of the smallest power—that he may be compelled, at the same time, to use the labour of ten men instead of one. The objection would be too absurd upon the face of it. But a press of any kind is an *old* machine. A machine for beating books is a *new* machine. Working men, and other men, who ought to know better, have attempted to draw distinctions between old machines and new machines. As it is, the inventors of machines generally go before their age; and thus too many of them have either starved or struggled for years with want, because their own generation was not wise enough to value the blessings which science and skill had provided for it. But if the ordinary difficulties of establishing a new invention, however valuable it might prove, were to be increased by the folly which should say, we will have no new machines at all, or at any rate, a machine shall become old before we will use it, there would be an end to invention altogether."

After all, why should we be surprised at journeymen printers and bookbinders entertaining such mistaken notions when every body knows that these notions have their open advocates in all walks of life—even the very highest? Have there not been resolutions of justices as well as of journeymen against machinery? And have not the walls of both houses of parliament resounded with complaints of the manifold evils which the progress of mechanical improvement is bringing on the country? The truth is, that the prejudice we are contending against, pervades all ranks of British society to an extent which it is quite humiliating to think of. It shows that with all our freedom, all our facilities of acquiring knowledge, and all our boasted enlightenment, great numbers of us are still in a state of great darkness—so deplorably blind, as to be blind to the great source of all the blessings we enjoy. Most truly was it remarked by the correspondent, to whose letter we have before alluded, that were such demands as those of the journeymen printers to be listened to, the whole of that "complicated machine of society, which it has taken centuries to construct and put together, would be pulled to pieces in a few months;" and that it is to the refusal of such demands, "England and Europe owe their present glory." The same view of the matter is excellently enforced in the following eloquent passages of the little treatise before us.

"Society must either go forward or backward. There can be no halting place for any long period. * * * If the present state of popular feeling were to prevail and extend—if the brute force which seeks to destroy machinery were not to be put down by the power of the laws, and if the unwise prejudice which desires to depress it could not be conquered by the power of reason—the glory and prosperity of this country would be gone for ever. We should have reached the end of our career of improvement. We should begin a backward race; and it would remain for the inquiring savages of such countries as New Zealand and Otaheite to march forward. The night of the dark ages would return to Europe."

* * * *

"There would be no new capital employed to give facilities to commerce and manufactures, whose prosperity is mainly the result of machinery. There would be no more capital for public works, which employ thousands of workmen in their construction. Would the rail-way from Birmingham to London be proceeded with, in which a capital of three millions sterling is to be employed, if the artisans of Birmingham were to break their machines? There would be an end of the commerce of Birmingham in that case; and then the rail-way would be given up, for the existing canals would have no employment, and there would be no traffic on the roads. The only use of roads would be to enable the starving workmen, (starved by their own folly,) to wander about the country in search of that profitable labour which they had destroyed. They would wander about in vain. The capital would make itself wings and fly away to other countries, where men still acted as reasonable beings. Our capital, our machines, and our best mechanics, would go to France and America. The tyranny of a mob would drive away the wealth and industry of the nation to places where they could be employed in security, just in the same way as the tyranny of a king drove the French silk and cotton weavers to this country a century and a half ago. The effects of all tyranny are the same, whether it be that of one despot or of many despots. Tyranny of any kind destroys our peace and our security. When men are in terror they try to save what they have got, instead of endeavouring to get more. Capital no longer does its work, labour is at an end.

"It is easy to perceive from these facts, which cannot be denied, that if, through the prejudices of some mechanics against machinery, the capital engaged in manufactures should be rendered as insecure as the capital engaged in agriculture, capital would go to other countries where such insecurity did not exist. The insecurity of capital employed in agriculture, and of capital employed in manufactures, would extend to capital employed in commerce; and the want of employment of capital in each of these great branches of human industry would produce a state of misery which it would be fearful to contemplate. We should all be more or less without food, without fuel, without clothes. The land would cease to produce corn, the mines would cease to produce ore, the forges would cease to produce tools, the looms would cease to produce cloth. There would be

> 'No kind of traffic,
> *   *   *   *   no name of magistrate;
> Letters should not be known; no use of service,
> Of riches or of poverty; no contracts,
> Successions; bound of land, tilth, vineyard, none;
> No use of metal, corn, or wine, or oil;
> No occupation; all men idle, all,
> And women too.' "

"The poet has well described the state of a community without industry, because without capital. It is the state of savages who bear its hardships, and who are few in number, because they are thinned by those hardships. But let a nation of twenty millions of people,

by any act of folly, drive capital away from them, and famine, pestilence, civil war, midnight murder, rapine, and every other dreadful calamity, would follow this unnatural violation of the laws of God and man. The twenty millions would soon be reduced to one million; the country would fall back a thousand years. We should all be idle, but our idleness would not feed or clothe us; we might all desire to labour but there would be no accumulation to give us profitable labour. We should all be prodigals who had spent our substance, and there would be no forgiving parent's home where our misery might be pitied and relieved when it is past endurance. The friend whom we had driven from us would never return. We could not go to the capital; the capital would not come back to us. The land would be depopulated, and rendered barren; and then the few that remained would have slowly to emerge from poverty and barbarism, by going back to the arts which the world has been laboriously acquiring for thousands of years."

Are there, then, really no evils attending the introduction of improvements in machinery? It is admitted that "every change produced by the substitution of a perfect machine instead of an imperfect one, of a cheap machine instead of a dear one," is a change which "more or less affects the interests of capitalists as well as of workmen," and "has more or less in it of the positive suffering and heart-wearing uncertainty which belongs to all change:" but it is on the other hand, very justly observed, that any injury such improvements may cause to individuals is only partial and temporary, while the benefits flowing from them are universal and permanent. "Every improvement brings healing upon its wings, even to those for whom it is a momentary evil—if it displace their labour or their capital for a season, it gives new springs to the general industry, and calls forth all labour and all capital to higher and more successful exertions." The evils, too, attending that state of change which necessarily follows a state of improvement, are susceptible of great mitigation; a wise government may do much towards that end—individual foresight and exertion still more. What the British government might accomplish in aid of British industry, the author of the treatise before us, professes not to discuss; but he has devoted a concluding chapter to showing the working people "the means which they possess in themselves" to bear up against every change that can befall them. The first thing, he says, they should do, is to get knowledge—*such* knowledge, that when deprived of one employment they may easily turn to another; the next, to get capital, that is, to lay by some money, on which they may fall back for support when they cannot dispose of their labour to advantage. No one can find fault with these precepts; so far as they go they are excellent; but who can say they go far enough? Are the means of getting knowledge and saving money so certainly within the reach of every working man in this country, that it can be fairly said to be his own fault if he is not possessed of a competent share of both? May not the march of honest industry be so impeded by artificial obstructions—by grievous imposts and annoyances at every step—that even the

best-disposed and the most hard-striving shall have good reasons to despair of ever getting above the pressure of their daily necessities? And if such artificial obstructions exist, ought it not to be one of the first concerns of the working man to have them removed? The writer of this treatise says, in the name of the society of which he is the organ, "it is not *for us* to point out what may be expected from the collective exertions of society;" *we* shall not attempt to discuss that part of the question which belongs to the duty of a government;" "*our* business is with the people themselves." But why the "*not?*" We must confess we do not comprehend the distinction here attempted to be drawn. What are the people without rulers, or rulers without a people? And though your business be only with "the people themselves," can you do better than tell the people how they may get rid of any shackles which a succession of foolish or iniquitous rulers may have imposed on them? It might not, we are aware, look well, or work conveniently, to see a society with a Lord Chancellor for its chairman, and a Chancellor of Exchequer, and the King's Attorney-General, on its committee of direction, urging the working classes to *agitate their grievances*—to besiege the houses of parliament and the palace of the King with supplications for the repeal of this or that oppressive burden—the repeal of the coal tax for example, which bears the hardest perhaps of all our public burdens on manufacturing industry,* or the removal of the fees on patents, which exacted for the enrichment of a few officers of the crown, (the Lord Chancellor and Attorney-General themselves among the number,) form one of the greatest obstacles to that advancement in mechanical improvement which it is the professed object of this treatise to promote. But though office, and the fees of office, may be very good reasons why the Lord Chancellor's Society for the Diffusion of Useful Knowledge should *now* be silent on such topics, they furnish no reason for the people being silent upon them. They only show how awkward a thing it is for *Ministers of the Crown* to write *books for the people.* Although professing to do "the business" of the people, they are obliged, from considerations personal to themselves, to leave one-half of that business undone. We think that no one can doubt that if the chairman of the Society for the diffusion of Useful Knowledge had been still plain Henry Brougham, he would have held it to be his very first "business with the people" to point out what their rulers ought to do for them as well as what they ought to do for themselves, and to exhort them to meet and petition, and remonstrate incessantly, till every unjust impost and vexatious regulation was abolished. But plain Henry Brougham is now Lord Brougham, and a leading member of the Cabinet as well as Chairman of the Useful Knowledge Society; and what it may be proper for him in the one capacity to say to the people, it is not expedient for him to say in the other; and so, to get

* See "Observations on the Duty of Seaborne Coal, and on the Peculiar Duties and Charges on Coal in the Port of London," an excellent pamphlet, just published by Messrs. Longman & Co. It is perfectly unanswerable.

over the difficulty, the whole of "that part of the question which belongs to the duty of a government" is left untouched! Not *altogether* untouched, however; for though the treatise before us says nothing about what the people should demand from their rulers, it is not wanting in significant hints of what the rulers *will do* if the people should think of taking the redress of their grievances into their own hands. At page 25 we meet with these words—"if the laws were passive, *which they will not be*, the most ignorant of the labourers themselves would see," &c. The portentous "*which they will not be*," is given in the original, as here, in italics, to impress the fact more forcibly on the mind of the reader, that the reader is speaking as with the voice of authority. The "schoolmaster" no longer chooses to discourse to you of popular grievances, but he shakes his birch as usual. Surely this little display of power might well have been spared. If it be true, (as who can doubt?) that nothing so disposes men to submit to hardships as a knowledge of the causes to which they are owing, and a conviction that they are in a course of being speedily remedied, so, on the other hand, it is very certain that if you tell a man that every thing depends on himself, when both you and he know well that much depends on others, and if you further make use of the terrors of the law to enforce this delusive half view of the case, nothing is more likely to make the counselled turn a deaf ear to those who counsel him. "Get knowledge and get money"—this is the sovereign panacea of the Useful Knowledge Society; but experience tells us there are many difficulties and obstructions in the way of getting knowledge and money, which, originating with the government, ought by the government to be first removed. It is altogether fallacious to say that the remedy "rests with the people themselves"—fallacious at least, in the sense in which these words are used by the Useful Knowledge Society: for, to reconcile them to truth, we must include in what "rests with the people themselves" the right and the duty of petitioning for a redress of grievances; which right and duty are passed over by this society as of no account in relation to the question of want of employment. The society recommend, that when a workman is thrown idle by machinery, he should "strike into some new line of labour." But what, if in every new line which he thinks open to him he should meet with a lion in the path, in the shape of law of settlement, corporation privilege, government license, or something else equally oppressive and ridiculous? The society evidently blink a most important branch of the inquiry, when they do not show the workman how he may be freed from every restraint on his industry, and what he can himself do to work out his freedom. And they blink it—not because it is unfit the workman should be told this—but because it is unfit for a society, whose leading members have become Ministers of State, to play any longer the part of political agitators. We said, at the first establishment of this society, that it was not likely to work well for any great length of time; and that it owed its first chances of success mainly to the circumstance of its promoters being, for the time, in (what is called) opposition to the government—all for the people, and the

people's rights and interests. Verily, our anticipations are beginning to be realized.

Nevertheless, we acknowledge, most unreservedly, that, for the present treatise, so far as it goes, the British public have every reason to feel grateful; we must confess, too, that the defect which we have pointed out is a consequence of personal circumstances, which is more to be regretted than severely censured. Some other pen, less fettered by official considerations, will probably supply that branch of the inquiry which this treatise has left untouched; and though we have no longer the pleasure of seeing a Brougham and a Denman heading the popular array against the abuses of our political system, it is assuredly a great source of consolation, that they have been elevated, by their eminent talents and virtues, to offices which give them more power than ever, to carry into effect those reforms which it has been the great business of their lives to advocate and enforce. [*Mechanics' Magazine.*

Biscuit Baking by Steam.

Until within the last few years, all the flour and biscuit consumed in the navy was furnished by private contract. The most flagrant impositions and frauds were but too generally the consequence of this mode of supply, in defiance of all the vigilance of the heads of departments. The flour and biscuit were stipulated to be of the second-best quality; but instead of this, the former was generally mouldy, damaged, or of a very inferior description to that bargained for; while the latter was usually compounded of bad flour, bean meal, old worm-eaten biscuits ground down, and various other cheap or unwholesome materials. To obviate these frauds, government, a few years ago, erected steam-mills at Deptford and Portsmouth, for the purpose of grinding flour for the navy; and a very superior and cheaper article being the result, it was determined, in addition to grinding the flour, to attempt also the manufacture of biscuit from it, at these establishments. The impossibility of accommodating and effectually superintending the multitude of bakers required to knead the dough in the usual way, by hand, so as to effect the supplying of the whole navy, would have rendered this praiseworthy effort, in a great measure, abortive, had not the ingenuity of Mr. Grant, storekeeper at Portsmouth, obviated the difficulty. By the attachment of a few simple pieces of machinery to the engine driving the flour-mill, the dough is now worked, rolled out, and stamped into biscuits, with an expedition inconceivable, and with a saving of two-thirds of the number of bakers required to perform these processes by hand. The flour and water are first put into a trough, through which passes an iron spindle, armed with eighteen knives, in two rows, *i. e.* nine in each row, on opposite sides of the spindle. A strap connected with the engine turns the spindle round; and by means of the revolving knives, the flour and water are in a few minutes worked into dough fit for being stamped into biscuits. The dough is now taken

piecemeal from the trough, and shaped by hand into longish rolls, upon two moveable baking-boards, supported by small iron pillars, having castor-wheels at top: these pillars are in three rows, extending from the trough to the two rolling machines; and along the castors upon their tops the baking-boards are pushed, by hand, towards the rollers, under which the dough is rolled out into thin cakes, by their backward and forward swinging motion. The baking-boards are now pushed out, by hand, from under the rollers, and slided along three other rows of pillars connecting the two rollers with the two cutting machines, each containing forty-two hexagonal dies, under which they are momentarily placed, and eighty-four biscuits thus cut out by a single stamp of the two machines. The kneading, rolling, and stamping portions of the machinery, being all separate, can consequently be put in motion or at rest at the will of the baker. By the machinery at Portsmouth, under Mr. Grant's superintendence, 160,000 pounds of biscuit can be manufactured in twenty-four hours—constituting a day's ration for the crews of twenty sail of the line; and with eight or ten such pieces of machinery, biscuit rations may be daily manufactured for 160,000 men, being the greatest number of seamen and marines employed during the hottest period of the war. About 5,000*l.* has been expended in erecting the baking apparatus at Portsmouth; a considerable portion of which expense was naturally occasioned by the alterations and improvements consequent on the erection of a new piece of machinery; but even this sum will be refunded to government during the first year of its employment, by the saving made. This saving of expense, however, is not the only recommendation—the biscuit being free from flutiness, and in every respect more palatable than that baked by hand, in consequence of being more thoroughly kneaded. From the rapidity of the manufacture, also, no more biscuit need now be baked than is required for immediate use, from the supply by this process being as certain as it is rapid; so that our seamen will in future have always fresh-baked and wholesome biscuit served out to them, even on foreign stations, instead of the stale, mouldy, worm-eaten, and unpalatable contract trash generally furnished during the war, which had often been baked for years before issued. It is only those who have been doomed to the penance of the contract flour and biscuit that can duly appreciate the great boon conferred upon our brave seamen by this project of the government; the above articles now supplied to the navy being very superior in quality to those furnished the merchant service—such, indeed, as are fitting for any gentleman's table; and all this at a much lower cost than the former contract supplies.

The first bags of biscuit of this manufacture having, in addition to the usual King's mark of the broad arrow, the word "machinery" stamped in capital characters upon them, this novel and imposing symbol at once struck the eyes of the superstitious tars as something very mysterious, and many were the solutions attempted of the enigma; until one, more deeply read than the rest, dropping upon one knee, and rolling his quid round and round in his mouth, while

tracing with his finger and spelling and re-spelling over and over the ominous word, at length started up from his reverie, and exclaimed with an oath, "Why, it aan't only the name of the squab of a baker—Mac Henry, Mac Henry, that's all that's in it!" and the "machinery biscuit" is now, consequently, known among the tars by the cognomen of "Mac Henry's biscuit." P. C.

[*Literary Gazette.*

The Silver Isis Medal and Five Pounds were presented to Mr. T. Lowthorp, *25 Crescent street, Euston Square, for his Emery Cloth; samples of which have been placed in the Society's Repository.*

There is an immense consumption of sand paper and of emery paper, both in private families for cleaning furniture and utensils of iron and steal, and still greater in manufactories of hardware of all descriptions. But paper is so brittle that it will not hold together after having been used a little while, and, unfortunately, this happens just when its quality as a polisher is the best, from the coarser grains of sand or emery having been rubbed off.

By substituting the cheapest kind of calico for paper, the candidate has produced an article, the durability and utility of which far exceed the additional cost required by the substitution of cloth for paper.

The sand, pounded glass, and emery, are to be sorted by washing over in the usual way, and then are to be dried for use.

The calico best suited for this purpose should be thirty-two inches wide, of a strong even thread, but not too coarse, and which has been as little dressed as possible. It is to be put into stretching frames two yards long, and, after being wetted with warm size, is to be stretched to a width of thirty-six inches. The size employed for this purpose is composed of 2 lbs. of good glue, dissolved in six quarts of warm water, and then mixed with two quarts of water that has previously been boiled with half an ounce of alum; and six ounces of good wheaten flour. The mixture is to be put over the fire in any convenient vessel, and, when it begins to bubble, is to be poured out into a pan for use.

On the dry calico, still in the frame and stiff with the coating of size, is to be laid on another coat of a stronger size, made by dissolving 4 lbs. of glue in three quarts of warm water, and adding one pint of the first size, together with an ounce of gum arabic and an ounce of gum tragacanth.

While this strong size is yet wet, the emery, sand, or glass-powder, is to be sifted on as evenly as possible, and the calico is again set to dry, and is afterwards brushed, to remove the loose particles: a second coating of strong size is then to be laid on, and is to be covered with another layer of sifted emery, &c. It is then again to be dried and brushed, and is now ready to be removed from the frame, and cut up into sheets for sale or for use.—[*Register of Arts.*

On the Illumination of Light-Houses. By Lieut. Thomas Drummond, *of the Royal Engineers.*

[From Abstract of Meeting of Royal Society.]

The author, after briefly describing the different methods at present employed for illuminating light-houses, proceeds to detail what he considers an improvement upon those now in use. This consists in substituting for the Argand burners a small ball of lime, ignited by the combustion of oxygen and hydrogen.

From this small ball, only three-eighths of an inch in diameter, so brilliant a light is emitted, that it equals in quantity about thirteen Argand lamps, or 120 wax candles; while, in intensity or intrinsic brightness, it cannot be less than 260 times that of an Argand lamp. These remarkable results are deduced from a series of experiments made lately at the Trinity-house; and, having been repeated with every precaution, and by different individuals, there seems no reason to doubt their accuracy. In the best of our revolving lights, such as that of Beachy Head, there are no less than thirty reflectors, ten on each side. If, then, a single reflector, illuminated by a lime-ball, be substituted for each of these ten, the effect of the three would be twenty-six times greater than that of the thirty. On account of the smaller divergence of the former it would be necessary to double their number, placing them in a hexagon instead of a triangle. In this case the expense is estimated at nearly the same. This method was tried lately at Purfleet in a temporary light-house, erected for the purpose of experiments by the corporation of the Trinity-house, and its superiority over all the other lights with which it was contrasted was fully ascertained and acknowledged.

On the evening of the 25th of May, when there was no moon-light, and the night dark, with occasional showers, the appearance of the light viewed from Blackwall, a distance of ten miles, was described as being very splendid. Distinct shadows were discernible, even on a dark brick wall, though no trace of such shadows could be perceived when the other lights, consisting of seven reflectors with Argand lamps, and the French lens, were directed on the same spot. Another striking and beautiful effect peculiar to this light was discernible when the reflector was turned, so as to be itself invisible to the spectator. A long stream of rays was seen issuing from the spot where the light was known to be placed, and illuminating the horizon to a great distance. As the reflector revolved, this immense luminous cone swept the horizon, and indicated the approach of the light long before it could itself be seen from the position of the reflector.

These singular effects, must not, however, be understood as constant accompaniments of this light, for on a moon-light night, or when the weather is very hazy, they cease to appear.—[*Jour. of Roy. Ins.*

Photometer, or Instrument for measuring the relative Intensity of two Pencils of Light. By Mr. W. Ritchie, A. M. F. R. S.

[From the Transactions of the Society of Arts.]

A PHOTOMETER is an instrument for the purpose of comparing the relative intensity of light given out by different bodies in a state of combustion or incandescence. There are two modes of measuring light, either by the actual comparison of the lights themselves, or of the shadows produced by intercepting part of the lights. The former was employed by Bouguer, to whom is owing the construction of the first photometer, and the latter by Count Rumford.

The general mode of operating is the same in both; that is, the two lights or shadows to be compared are brought to an apparent equality on a particular spot, and the relative intensity is obtained by measuring the distance from this spot to each of the luminous objects, and then squaring the distance so found. Thus, if the lights or shadows of two lamps are equal, one being at the distance of two, and the other of three feet, the illuminating power of the former will be expressed by four, and of the latter by nine.

In practice, it is found more convenient to have the lights stationary, and to move the photometer, than the reverse; and it is on this latter principle that Mr. Ritchie's photometer is constructed and employed. It consists of two mirrors, placed at right angles to each other within a wooden box open at both ends, in order to admit the rays from the two luminous objects to be compared: these rays are reflected upwards to a slit in the top of the box, which slit is covered with semi-transparent white paper. A wooden trunk, widening upwards, is raised upon this slit, for the purpose of enabling the observer to compare the two portions of reflected light without disturbance from any other rays. The two lights to be compared, and the two mirrors, being brought into one straight line, the photometer is to be moved along this line till the reflected rays from both objects appear to be precisely equal: the relative distance of each from the photometer being then measured or read off, these numbers squared give the relative intensity of each light.—[*Rep. of Pat. Inven.*

CLEMENT'S *Experiment—Easy Mode of Repeating it.*

THE very curious, and apparently paradoxical experiment, first described by Clement, in which air, gas, or steam, issuing with force from a hole in a flat surface, did not blow away a platter or other flat and extended body, but rather caused its adhesion, has been repeated since in a great variety of forms. M. Hachette contrived a simple little apparatus, by which every one was put in possession of the power of witnessing the effect: and such facilities are valuable, because they rapidly extend the knowledge of curious effects, and cause them to be still more extensively pursued and investigated. The experiment may be still further simplified in the following manner. When the fingers of the open hand are retained as close to each other

as they can be, still there are certain slit-like intervals between them extending from joint to joint. Let the hand be held horizontally with the palm downwards, apply the lips to the interval between the second and third fingers nearest to their roots, and then blowing with force, a strong jet of air will of course issue from the aperture at the under side of the hand. Now, put a piece of paper or a card three or four inches square against that aperture, and again blow; it will be found that the paper will neither be blown away, nor fall by its own weight, but will be pressed upwards against the hand and the issuing current of air, so long as that current continues. The moment it ceases, the paper will fall away by its own gravity, in obedience to the ordinarily active laws of nature.—M. F.

[*Jour. of the Roy. Institu. Feb.* 1830.

On the Discharge of a Jet of Water under Water. R. W. Fox, *Esq.**

The following letter is addressed to the Editors of the *Philosophical Magazine.*†

"I am not aware, that it has been before noticed, that a jet of water discharges the same quantity, in water, as in air, in a given time, without reference to the depth or the motion of the water, at least within certain limits. Thus when the experiment was tried with a head of water six feet high, the same orifice discharged equal quantities in equal times, in air, in still water, and in a rapid stream, moving at the rate of about six feet in a second; the jet having in one case been turned with the current, and in another against it: and when, by lengthening the tube, the aperture was submerged to the depth of fifteen feet, the effect was the same as at the surface, under the pressure of an equal column above it. These results have been obtained by my brother Alfred Fox and myself, and you may perhaps think them deserving a place in your magazine, if they should appear to you to be new.

"We sometimes coloured the water, when the jet appeared to pass unbroken to a considerable distance under the water."—*Ib.*

On Preventing the Discharge of a Bullet from a Gun by the Finger.

At the sitting of the Helvetic Society of Natural Sciences of the 28th July last, a letter was read from Dr. Flachin of Yverdun, relative to an experiment before mentioned to the society, in which the

* By a reference to the 2nd volume of this Journal, page 61, it will appear that experiments on this very subject, with a similar result, were made by James P. Espy, of Philadelphia, in the year 1828. These are his words: "I have lately ascertained, by some experiments in hydraulics, (which I shall publish before long,) that as much water runs out in a given time through a hole in the side of a vessel containing water under a given head, when the egress is made below the surface of water, as when it is made in the open air."

† Vol. viii. p. 342.

ball was prevented from leaving the bottom of a musket when the gunpowder was fired, simply by putting the ramrod upon the ball, and the end of the finger upon the ramrod. He supposes the effect may be explained by the circumstance, that near the charge the ball has a very small velocity compared to that impressed upon it by the expansive force of the gases from the fired gunpowder, when exerted during the whole of the time in which it is passing along the barrel. It is well known that the effect thus accumulated is the reason why long pieces carry further than short ones, and why the breath of a man, which cannot exert a pressure of more than a quarter of an atmosphere, may, by means of a tube, throw a ball to the distance of sixty steps. The experiment above requires great care, especially as to the strength of the piece, which is very liable to burst in the performance of the experiment.*—[*Ib.*

New Lamp.

AMONG the useful applications of scientific knowledge to our improvement in domestic articles, we have this week to mention a lamp of a new construction, and on a new principle, which was exhibited on Friday at the Royal Institution, and one of which is now burning on our table before us, affording us the light by which we describe its brilliancy and good qualities. It is the invention of Mr. Parker; and certainly for illumination is equal to oil gas, which it surpasses in steadiness and equability. The essence of the invention is, that a column of air keeps the oil always at the proper height of the wick, so that the flame is continually of the same splendour, without flickering. Yet the machinery is most simple, and the form agreeable. There are no rims to cause shadows; and altogether we do not know when we have been more pleased with a thing of the kind for daily use or ornament. The new lamp is truly a new light.—[*Lit. Gaz.*

Extraction of Potash from certain Minerals.

THIS alkali, so important in the arts, may, it is stated, be extracted from minerals containing it, by a very ample process. This consists in merely calcining them with lime, and then leaving them for some time in contact with water, which is afterwards filtered and evaporated. M. Fuchs, as quoted in the *Ann. de l'Industrie*, states, that he has in this manner obtained from 19 to 20 per cent. of potash from felspar, and from 15 to 16 per cent from mica.—*Ib.*

On the Machinery for Making Paper.

AT a meeting of the Royal Institution, in London, Mr. Cowper read a paper on the recent improvements in paper making.

These observations were intended as an appendix to a lecture on the same subject, delivered by Mr. Millington in this Institution two

* Bib. Univ. 1830, p. 447.

or three years ago. Mr. Cowper described the mode of making paper by the machines of Hard and Fourdrinier, for the sake of those of his auditors who were not present at the former lecture. Next, the beautiful machine invented by Mr. Dickenson was illustrated by drawings and experiments. This machine differs considerably from Fourdrinier's: in the latter, the pulp flows upon a horizontal web of wire, about thirty feet in length, stretched on rollers, upon which it revolves; the water from the pulp flows through the web, and leaves the paper on its surface; and as the water drains from the pulp merely by its own weight, it requires about 11 feet in length of wire-web, moving at the rate of 22 feet per minute, or, in other words, half-minute time, to allow the pulp to become sufficiently set before it can be taken off the wire. In Mr. Dickenson's machine, a perforated brass cylinder, about 20 inches in diameter, covered with wire-web, and nearly immersed in the pulp, is substituted for the endless web in Fourdrinier's. The idea is very ingenious. The cylinder is turned truly inside and out,—it is perforated all over by holes and grooves, so disposed that when covered first with a layer of plain wires, and afterwards with the wire-web, there is no part of the wire-web which does not communicate with the interior of the cylinder. The ends of this are closed, and it revolves on a hollow spindle or pipe, which has two or three small branch pipes, bent downward within, but not touching the cylinder: these pipes, from their action, may be called siphons. An air-pipe enters the hollow spindle at one side of the cylinder, and is bent towards the interior upper surface, where it is united to a sort of trough, the edges of which apply themselves closely to the interior, by means of packing, *i. e.* the interposition of any elastic substance. A vacuum is constantly produced in this trough by the air pump: the trough extends 8 or 10 inches along the circumference of the cylinder, all of which part is above the surface of the pulp, in which the rest of the cylinder is immersed. As the cylinder revolves, the water flows through the wire-web into the interior, whence it issues by the siphons through the hollow spindle. The current of water flowing through the wire draws the floating fibres against the cylinder, and the paper continues forming, till, in the course of its revolution, it rises over the vacuum trough. Here the pressure of the atmosphere comes into action, and the remaining water is instantly forced through the wire-web, and the sheet taken up by a blanketed roller. The paper is thus made in the space of a few inches, the machine moving at the rate of 48 feet per minute. Mr. Cowper exhibited a working model of the machine invented by him for preventing the loss, by what, we believe is technically called shavings; a loss varying from one-sixth to one-twelfth of the whole paper manufactured. The model was furnished with a reel of tissue paper, about 200 feet long: the longitudinal cutting is effected by circular knives, and the transverse cutting by a serrated knife, which divides the paper easily, accurately, and with a sufficiently small edge. A drawing was also exhibited, to illustrate Mr. Ibbotson's new strainer for preventing the knobs which are sometimes found in paper. Mr. Cowper concluded by noticing the gratifying results of the improvement in paper making and print-

ing machines; observing that the Bible Society expended between 50,000*l.* and 60,000*l.* annually on paper and printing; the Tract Society also, he stated, frequently printed upwards of 400,000 of a single tract; other societies for the diffusion of knowledge, whose names he mentioned, printed of each number of a series as many as 20,000; and of the new editions of Sir Walter Scott's Tales about 1000 volumes were printed in a day. [*Ib.*

To our Cotemporaries.

We must remind certain of our cotemporaries across the water, that courtesy requires the acknowledgment of the source whence articles are derived, particularly when they are of considerable length and value; we trust these general remarks may suffice.

Com. on Pub.

Meteorological Observations for June, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2, P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	71°	92°	30.00	29.94	60	West.	Moderate.		Hazy morn.—clear & dry.
☾	2	74	92	29.95	.94	62	West.	do.		Clear day.
	3	76	87	.84	.80	64	West.	Breeze.		Cloudy day.
	4	76	83	.74	.74	64	West.	do.		Cloudy day.
	5	72	77	.65	.70	62½	S. S.	Blustering.	.47	Rain-cl'dy.-rain in night.
	6	61	82	.83	.88	57	W. W.	Moderate.	.10	Clear day.
⊗	7	65	86	.90	.90	59½	NW. E.	do.		Clear day.
	8	65	82	.90	.90	52	NW. NE.	do.		Clear day.
	9	60	81	.94	30.00	60	E. S.	do.		Fog—clear.
	10	67	85	30.04	.04	64	SW. W.	do.		Fog—clear.
	11	68	86	30.00	29.95	67	W. W.	Breeze.		Fog—clear.
	12	68	86	29.80	.83	64½	W. W.	do.		Clear day.
	13	71	84	.80	.85	66	SW. S.	do.		Cloudy—clear.
	14	70	81	.85	.85	68	SE. S.	do.	2.22	Cl'dy—cl'r—thun. shw'r.
☽	15	66	82	.90	.90	65½	W. W.	do.	.12	Cl'dy-shw'r. [rain night.
	16	64	80	.90	.86	68	W. SE.	Moderate.	.2	Cloudy—slight shower.
	17	67	84	.86	.86	67	NE. W.	do.		Fog—Flying clouds.
	18	68	87	.80	.84	74	W. W.	do.	.2	Fog—clear—shower.
	19	70	84	.84	.84	72	W. W.	do.		Cloudy day.
	20	71	84	.90	.90	68	W. W.	do.	.2	Clear—cloudy—rain.
	21	72	84	.80	.80	70	SE. W.	do.		Cloudy day.
	22	69	82	.80	.90	55	W. W.	do.		Clear—flying clouds.
	23	66	68	.85	.85	58	NE. NE.	do.	.65	Rain.
☺	24	53	70	30.10	30.15	42	W. N.	do.		Clear day.
	25	53	72	.10	.00	48	W. W.	do.		Clear day.
	26	60	77	.00	.05	57	W. W.	do.		Cloudy—clear.
	27	64	77	.10	.05	61	W. SSE.	do.	.1	Cloudy—rain.
	28	70	75	29.90	.90	68	SW. SW.	do.	.6	Flying clouds—rain.
	29	69	80	.70	.70	62	SSE. W.	do.	1.80	Cloudy—flying clouds.
	30	65	80	.80	.90	62	W. SE.	do.		Clear day.
	Mean	67.03	81.67	29.88	29.89	62.3			5.49	In. of rain in the month.

	Thermometer.		Barometer.	
Maximum height during the month,	92.	on 1st and 2nd.	30.15	on 24th.
Minimum do. . . .	52.	on 24th and 25th.	29.65	
Mean do. . . .	74.35	. . .	29.885	

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

AUGUST, 1831.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

[Continued from page 154, vol. vii.]

Having given a general description of the apparatus used in the experiments, the Committee proceed to state the methods employed in estimating the resistance arising from friction.

Experimenters have differed in the results of their investigations of the laws of friction. It results from the experiments of Coulomb, that the friction at the axle of a wheel, or of a roller, varies in the direct ratio of the pressure upon the axle, except in extreme cases. The late experiments of Mr. Rennie* indicate that when unguents are used, the ratio of friction to pressure is not the same for different pressures, the variation depending upon the nature of the unguent and the amount of pressure applied.

The Committee deemed it necessary, therefore, to determine with the apparatus to be used in their experiments, and under the probable loads to which it would be subjected, the relation between the friction and weight. It will be seen that this labour was much abridged by the fact that the experiments showed the ratio of friction to pressure to be constant, within the limits required by the investigations.

The experiments of Rennie have satisfactorily established that the

* Transactions of Royal Society of London, Part I. 1829, pp. 163 and 164; or Journal of Franklin Institute, Vol. V. No. 2.

friction of an axle remains the same, in proportion to the weight, under different velocities.

The frictions to be estimated by the committee, were those at the axis of the water wheel, and at the axis of the roller, or drum, above the wheel.

To ascertain the amount of friction at the axis of the wheel, a cord was wound about the barreling of the shaft; to this cord was attached a weight varied until it just maintained a velocity of six feet per second in the periphery of the wheel: the weight, thus found, gave the friction upon the gudgeons, when pressed by the weight of the wheel together with the weight representing the friction. The pressure upon the gudgeons being increased, by attaching masses of lead to the wheel at equal distances from, and on opposite sides of, the axis, the friction was found in the cases tried, viz. those within the probable limits of the weights to be borne in the experiments, to be proportional to the weight sustained by the gudgeons of the wheel. The proportion of friction to weight was found to be one and a half per cent.

The friction at the axis of the drum was ascertained by passing a cord over it; to the ends of this cord weights were attached, and the additional weight necessary to cause either extremity to descend with a uniform velocity, gave the amount of friction. By varying the weights at each end of the cord, it was found that in this case, as in that of the wheel, the friction was proportional to the weight borne by the gudgeons, and that the proportion of friction to the weight was one and a half per cent. This latter circumstance tends, as well as the former, to simplify the calculations relating to friction. The weights having been raised by the wheel through the intervention of a chain passing over a drum above, it is evident that the axis of the wheel was drawn upwards with a force due to the tension of the chain between the axis and the drum, that is, to the weights attached to the chain, thus diminishing the pressure upon the axis of the wheel, and lessening, in consequence, the amount of friction; but this tension increased the pressure upon the axis of the drum, and since the friction at that axis, by a given weight, was the same as that at the axis of the wheel, these two opposite effects balanced each other, and there remained the friction due to the weight applied to the chain.

As reference is necessarily made, in the calculations which follow, to the centres of gravity of the loaded parts of the wheel, it may not be amiss to state the manner in which these points were determined. The general remarks apply to the several wheels used, but the details refer to the largest wheel.

The water was supposed to be distributed uniformly over the loaded part of the wheel, a supposition very nearly accurate when the buckets are numerous and the wheel works within a close breast. A section of the wheel perpendicular to the axis, and midway between the rims, being taken, the weight of the water was supposed to be concentrated in that part of the periphery of a circle, a mean between the circles containing the interior and exterior edges of the buckets, which corresponded to the loaded part of the wheel. In Fig.

I, Plate V, *a*, *b*, *g*, represents the semi-circumference of this circle, a mean between the semi-circumferences A, D, F, I, and K, L, M, of Fig. I, Plate IV, the radius being 9 feet 9 inches in the case figured, viz. that of the large wheel. To find the arcs corresponding to the loaded portions of the wheel, this circle was described upon a large scale; the several points answering to those at which the water, admitted to the wheel through apertures Nos. 1, 2, &c. (Fig. I, Plate IV,) first struck the wheel, were laid down, as at *a*, *b*, *c*, *d*, *e*, and *f*, (Fig. I, Plate V,) the lowest point of the wheel, *g*, being taken as the point at which the water was discharged, the arcs sought were *acg*, *bcg*, *cdg*, *deg*, *efg*, and *fhg*. The centre of gravity of each of these arcs, was then found by the usual method. The diagram shows the chords, *ag*, *bg*, *cg*, &c. from which the lengths of the arcs were obtained, the lines bisecting these chords, and upon which the centres of gravity of the arcs are to be found, *ci*, *ck*, *cl*, &c., and upon these lines the points corresponding to the centres of gravity, viz. G, G', G'', G''', G^{iv}, G^{v}. By drawing lines parallel to *ag*, from the points thus found, the distances from the axis of the wheel, obtained by calculation, are shown upon the scale traced in the figure.

We shall now give the calculations of the amounts of resistance from friction, in the wheel and drum, under the various loads to which they were subjected in the course of the experiments.

First. Constant *inactive* weight borne by the gudgeons of the wheel and drum during the experiments.

Weight of the water wheel, -	2200 lbs.	
The whole weight of the chain was 318 lbs.; of this an average weight of 34 lbs. (20 feet of the chain,) rested upon the ground during each experiment, and that part of the chain between the barrel of the shaft and the ground (20 lbs.) acted to resist the motion of the wheel: deducting, therefore, 54 lbs. from the weight of the chain, we have for the constant *inactive* weight upon the gudgeons of the wheel and drum, derived from the chain, -	264 ,,	
Weight of the drum, - -	200 ,,	
Total constant inactive weight, -	2664 lbs.	
The friction upon this, at one and a half per cent, is - - - -		39.96 lbs.

Second. Constant weight *resisting* the motion of the wheel, which was borne by the gudgeons of the wheel and drum.

That part of the chain which was between the barrel of the shaft of the wheel and the ground, - - - -	20 lbs.
The iron basket used to contain the weight,	126 ,,
Three bars of lead, weighing together	111 ,,
Total constant resisting weight, - -	257 lbs.

Friction due to this weight at one and a half per cent, - - - -		3.85 lbs.
The total friction derived from the *constant weight*, is, therefore, - -		43.81 lbs.

The amount of friction due to the constant weight having been thus found, we proceed to the numbers which varied with the weights added in the experiments, and with the points of admission of water to the wheel.

CHUTE No. 1. (Fig. I, Plate IV.)

The centre of gravity of the water in the buckets of the wheel when supplied by this aperture, was 6.207 feet from the axis, and the barrel about which the chain was wound was 1 foot from the same axis; hence to raise 257 lbs. the constant resisting weight, and overcome a friction of 43.81 lbs. the constant friction just found, required a weight of water of - - - -	48.46 lbs.	
The friction due to this weight, is -		0.73 lb.
Constant friction derived above, - -		43.81 ,,
Whole amount of friction overcome in raising the constant weight of 257 lbs. -		44.54 lbs.
To find the additional friction due to each of the bars of lead which were used as weights, we have,		
Weight of the bar, - -	103.00 lbs.	
To balance this weight and the friction due to it, (103 lbs. + 1.54 lb.) or 104.54 lbs. required, at 6.207 ft. from the axis, a weight of water of - - -	16.84 ,,	
Total, - - -	119.84 lbs.	
Friction for each bar of lead, being that upon the weight just found at one and a half per cent. - - - -		1.80 lbs.

CHUTE No. 2. (Fig. I, Plate IV.)

In this case the centre of gravity of the water in the buckets, was 7.01 feet from the axis, to raise 257 lbs. and overcome the friction of 43.81 lbs. required, - - -	42.91 lbs.	
Friction due to this, - -		0.64 lb.
Constant friction as above, - -		43.81 ,,
Total friction due to constant weights, -		44.45 lbs.

For each additional bar of lead,—		
Weight of the lead, -	103.00 lbs.	
To balance this weight and the friction due to it, - - -	14.91 ,,	
Total, - - -	117.91 lbs.	
Friction for each bar of lead, -		1.77 lbs.

CHUTE No. 3. (Fig. I, Plate IV.)

The centre of gravity of the load was in this case 6.58 feet from the axis: to raise 257 lbs. and overcome a friction of 43.81 lbs. required, - - -	44.72 lbs.	
Friction due to this, - -		0.68 lb.
Add as before, - - -		43.81 ,,
Total friction due to constant weight, -		44.49 lbs.
For each bar of lead which was added,—		
Weight of the lead, - -	103.00 lbs.	
To balance this weight and its friction,	15.88 ,,	
Total, - - -	118.88 lbs.	
Friction due to each bar, - -		1.78 lbs.

CHUTE No. 4. (Fig. I, Plate IV.)

The centre of gravity of the load was 5.89 feet from the axis: to raise 257 lbs. and overcome the friction of 43.81 lbs. required -	51.07 lbs.	
Friction due to this, - -		0.76 lb.
Add as before, - -		43.81 ,,
Total friction due to constant weights,		44.57 lbs.
For each bar of lead added,—		
Weight of the lead, - -	103.00 lbs.	
To balance this weight and its friction,	17.74 ,,	
Total, - - -	120.74 lbs.	
Friction due to each bar, - -		1.81 lbs

CHUTE No. 5. (Fig. I, Plate IV.)

The centre of gravity of the load was 4.84 feet from the axis: to raise 257 lbs. and overcome a friction of 43.81 lbs. required -	62.15 lbs.	
Friction due to this, - -		0.93 lb.
Add as before, - -		43.81 lbs.
Total friction due to constant weights, -		44.74 lbs.

For each bar of lead added,—

Weight of the lead, - 103.00 lbs.
To balance this weight, and its friction, required, - - - 21.59 ,,

Total, - - - 124.59 lbs.
Friction due to each bar, - - . 1.87 lbs.

The water delivered through Chutes Nos. 5 and 6, acts principally by impulse, at nearly the extremity of the radius of the wheel; this remark applies to No. 5, more exactly, when the head of water above the aperture is considerable; for all heads above four feet, the centre of force was taken at nine feet from the axis.

Not only is the arm of the lever, upon which the water from apertures Nos. 5 and 6 acts, greater, but the direction of the impulse does not coincide with that of gravity, hence the amount of pressure is not the same with the weight, or the ratio of friction to the weight must be diminished. The friction for Chute No. 6, and for Chute No. 5, when the head is more than four feet, may be taken at three-fourths per cent of the weight. The amount of friction being but small, nice calculations upon these points would have been entirely useless.

Chute No. 5.—When the head is above four feet.

To raise 257 lbs. and overcome a friction of 43.81 lbs. requires a weight of water, at 9 feet from the axis, of - - 33.42 lbs.
Friction upon this at three-fourths per cent, 0.25 lb.
Add as before, - - - 43.81 ,,

Total friction due to constant weights, - 44.06 lbs.

For each additional bar of lead,—
Weight of bar 103 lbs. friction at one and a half per cent, - - - 1.54 lbs.
To balance this weight and its friction, required - - - 11.62 lbs.
Friction upon this at three-fourths per cent, - .09 ,,

Friction due to each bar, - - 1.63 lbs.

Chute No. 6. (Fig. I, Plate IV.)

The friction was sensibly the same with that for Chute No. 5, when the head at that chute was above four feet. Hence, the friction due to the constant weights was, - - 44.06 lbs.
And the friction for each bar of lead, - 1.63 lbs.

Chute No. 7.—Undershot.—(Fig. I, Plate IV.)

Here the water acting entirely by impulse, the centre of force may be assumed at 9.75 feet from the axis.

To raise 257 lbs. and overcome a friction of 43.81 lbs. required, at 9.75 feet from the axis, a weight of - 30.85 lbs.

Friction upon this at three-fourths per cent,		0.23 lb.
Add as before, - - -		43.81 lbs.
Total friction due to constant weights, -		44.04 lbs.

For each bar of lead added,—

Weight of bar 103 lbs. Friction upon this at one and a half per cent, - -		1.54 lbs.
To balance this weight and its friction, required - - -	10.72 lbs.	
Friction upon this at three-fourths per cent,		0.08 ,,
Friction due to each bar, - -		1.62 lbs.

The foregoing calculations were applicable until nine leads, (927 lbs.) had been added to the constant weight in the basket; this weight suspended the end, *o*, (Plate III. Vol. vii.) of the shaft of the wheel. Any addition of weight to this, pressed the gudgeon against its cap with a force which was to the tension of the chain produced by the weight added, as the distance from the point at which the chain acted to the other gudgeon, (*o'*, Plate III.) was to the whole length of the shaft. The whole length of the shaft was 9.25 feet, the point of suspension 1.66 feet from the end *o*, of course 7.59 feet from *o'*. If one lead of 103 lbs. be added to the nine supposed in the basket, the force drawing the shaft upwards will be 103 lbs. together with its friction 1.54 lbs. or 104.54 lbs.; to find its effect upon the gudgeon, *o*, we have the proportion, 9.25 : 104.54 : : 7.59 : 85.78, the force, in pounds, with which the gudgeon, *o*, is pressed against its cap. Subtracting this weight from 104.54 lbs. the total weight from which both the gudgeons are relieved, there remains 18.76 lbs. the force tending to draw the gudgeon *o'* upwards, or the weight from which that gudgeon was relieved.

To ascertain the friction when more than nine leads were added to the constant weight in the basket, we have,

Friction due to the weight of each lead of 103 lbs. - - - -			1.54 lbs.
Tension of chain between axis of wheel and drum pressing upon the gudgeons of the drum, - - - -		104.54 lbs.	
Force with which gudgeon *o* was pressed against its cap, -	85.78 lbs.		
From this deduct the weight from which the gudgeon *o'* was relieved,	18.76 ,,		
There remains the pressure upon the axis of the wheel, - - -		67.02 lbs.	

Total pressure upon the gudgeons of the

wheel and drum, by the addition of each lead after the ninth, - - - 171.56 lbs.

Friction upon this at one and a half per cent, - 2.57 lbs.

Friction due to each lead after the ninth, exclusive of the water required to overcome this friction, - - - 4.11 lbs.

When the water was admitted to the wheel through CHUTE No. 1.

To overcome 103 lbs. and the friction of 4.11 lbs. or 107.11 lbs., required, at 6.207 feet from the axis, - -	17.26 lbs.	
Friction due to this, - -		0.26 lbs.
Friction just determined, - -		4.11 lbs.
Total friction for each lead after the ninth,		4.37 lbs.

The friction due to the weight of water necessary to balance each additional lead and its friction, was so small that its variations when the water was applied through the different chutes, could with propriety be neglected. The variation from the friction given by Chute No. 1, in an extreme case, that of Chute No. 5, at a friction of one and a half per cent, is but .07 of a pound. The friction for each lead after the ninth, was, therefore, taken at 4.37 lbs. at all the chutes.

The necessary details in relation to the friction of the several smaller wheels, will precede the account of the experiments made with each of them.

Before passing to a detail of the experiments, it may assist the reader to give a brief statement of the principal points to which the researches of the committee were directed.

The first and most general subject for determination, was the mode of applying any given head of water, so as to produce the greatest ratio of effect to power expended.

To ascertain this point, regard was to be had to, and variations made in, the head of water, the diameter of the wheel, the point of application of the water to the wheel, the size of aperture through which water was admitted to the wheel, the form of gate which was applied to the chute, the form, number and position of the buckets, and the velocity of the wheel.

The second object was to determine for a given wheel, the form of bucket which would admit of the application of the greatest quantity of water, giving the maximum amount of effect, without diminishing the ratio and effect to power expended.

Wheels of four different diameters were used in the experiments; No. I, had a diameter of 20 feet, No. II, of 15 feet, No. III, of 10 feet, and No. IV, of 6 feet. A particular description of each wheel will precede the statement of the experiments made with it.

The experiments were begun with wheel No. I; this wheel, as has been stated in the general description, was 20 feet in diameter, 20

inches in breadth, and 16 inches, in the clear, between the cants, which were 6 inches deep.

The buckets first attached to this wheel were *elbow buckets*, these were $15\frac{1}{2}$ inches deep, with a width of elbow of 3 inches, and an opening at the throat of $2\frac{5}{8}$ inches. In sector A, B, C, (Plate IV,) these buckets are represented, *e*, *e*, &c.: the number around the whole circumference was fifty.

In the bottom of each bucket an air vent was provided, $\frac{3}{8}$ths of an inch wide and occupying the breadth of the wheel; each vent was placed in the upper part of the bucket, to which it belonged, as near as practicable to the elbow of the preceding bucket. The air vents were closed during the experiments when the contrary is not stated.

The overshot chute, delivering water to the wheel on the pitch-back principle, is represented at *d*, No. 1, Fig. I, Plate IV.

To this chute three different forms of gates were applied. The first, *a*, Fig. I, Plate IV, was formed of a block three inches thick, and was opened by a motion towards the right, given by the series of levers, l, l', l'', K, Plate I, (Vol. vii.) already described. The width of opening given by this gate was regulated by a series of notches upon a block, affixed to the top of the forebay, against which the end of the connecting rod, l', l'', (Plate I,) was carried. These notches were regulated by trial. The same method of gauging the width of the opening was applied to the other apertures. When gate *a* was opened, the water flowed between its end and the top of the chute. Table A contains the results of the experiments made with this gate, under different heads.

This series of experiments being completed, the gate *b*, Fig. II, Plate IV, was adapted to the same chute; this gate drew upwards, allowing the water to pass between the lower part of the gate and the floor of the chute. Experiments similar to those, with gate *a*, were then made; the results are given in table B.

Gate *c*, Fig. III, Plate IV, was next adapted to the same chute; this gate, of a wedge form, being drawn to the right, allowed the water to pass between the tops of the gate and of the sluice. Table C contains the results obtained with this gate.

The elbow buckets remaining in the wheel, experiments were made with different heads and different widths of aperture, the water being applied at Chutes Nos. 2, 3, 4, 5, 6, and 7 successively. These points of application, taken together with Chute No. 1, embraced the cases of overshot, breast and undershot wheels. The heights of the several apertures above the lowest point of the wheel are, No. 2, 17 feet; No. 3, 13.66 feet; No. 4, 10.46 feet; No. 5, 7 feet; No. 6, 3.66 feet. No. 7 was the undershot aperture. The horizontal lines *f g*, *h i*, *k l*, *m n*, and *o p*, show the points from which these several heights above the bottom of the wheel were reckoned. The chutes through which the water was delivered from these openings, were at the entrance 16 inches by $2\frac{1}{2}$ inches, and contracted in depth (the width remaining invariable) to 2 inches, at the end where the water escaped to the wheel.

The three forms of gates (*a*, *b* and *c*) having been found nearly equally effective, either one could be applied as the convenience of

opening and closing, in the position to be assumed by the gate might dictate. Fig. I, Plate IV, shows that Chutes Nos. 2, 3 and 7, were closed by gates similar to *b*, and chutes Nos. 4, 5 and 6, by gates similar to *c*. The experiments with each chute, under the various heads, will form the subject of one table.

The required results having been obtained with the elbow buckets, they were removed from the wheel, and the buckets represented in sector F, C, G, (Fig. I, Plate IV,) substituted, the faces converging to the centre of the wheel. The different heads of water were then tried with each chute, and with different widths of aperture, as before. These experiments will be presented with the others in a tabular form.

Air vents, similar to those already described, were provided in the bottoms of these buckets.

The series of experiments, with the *centre buckets* having been completed, the buckets figured in sector D, C, E, (Fig. I, Plate IV,) and afterwards those in sector H, C, I, were substituted. If from any point in the periphery of the wheel, two tangents be drawn to a circle, described with the centre of the wheel as its centre, and a radius of 15½ inches, we shall obtain the lines determining the two different buckets for that point; each bucket being equally inclined to, but on different sides of, the radius of the wheel drawn to the point, assumed, in the periphery. In sector D, C, E, the tangents to the upper side of the circle are drawn, determining the positions of the first set of *inclined buckets*. In sector H, C, I, the tangents to the lower side, giving the second set of inclined buckets.

In presenting the results of the experiments, each table will contain a single subject, and will be designated by a letter serving as a reference. To accommodate the tables to the size of the page, they will be divided into parts, designated by numbers. The general tables, as may be seen by table A, Part I, consist of 18 vertical columns, and in addition, a space for observations; each column has, at the bottom of the table, its appropriate figure of reference.

Column 1, contains the numbers by which any particular experiment may be referred to; the experiments are numbered from one upwards, through the whole extent of a table. The next three columns refer to the head of water used; column 2, containing the heights of water above the aperture; 3, the height above the top of the bucket, at which the water first strikes the wheel; and 4, the height above the bottom of the same bucket. The heads above the apertures were measured in apertures, Nos. 1, 2 and 3, by the heights above the lowest points of the tops of the gate-seats, in Nos. 4, 5 and 6, by the heights above the lowest points of the several gates when closed, and in No. 7, by the height above the bottom of the forebay, which was on a level with the bottom of the wheel. The lines *fg*, *hi*, &c. already referred to, are drawn through the points just designated, corresponding to apertures, Nos. 2, 3, 4, 5 and 6. The head, above the top of the bucket, was estimated for the overshot aperture, (No. 1,) by the height of the water above the highest point of the wheel; and that above the bottom of the bucket, by the height above the highest point of the soleing of the wheel. The heads, above the tops of the buckets, upon which the water first struck, were estimated for apertures, Nos. 2, 3, 4, 5 and 6, by the height of

Plate IV.

Fig. II

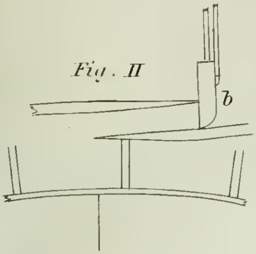


Fig. I

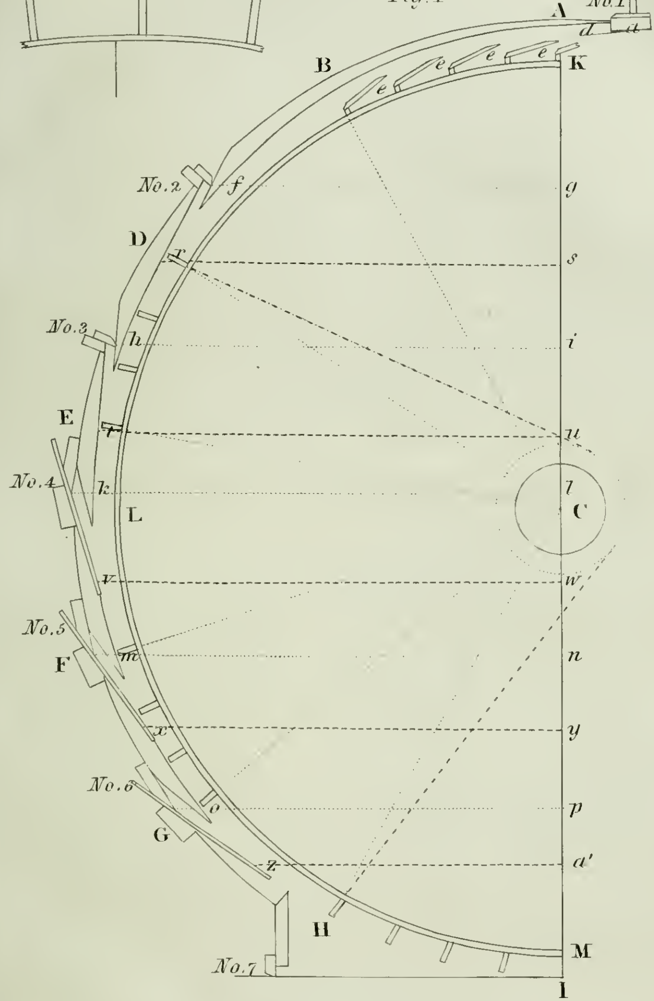
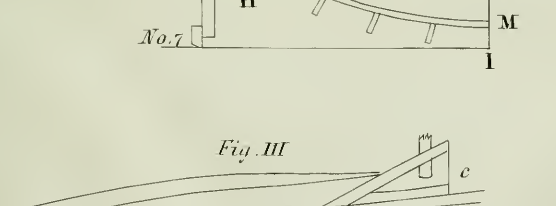


Fig. III



Scale ¼ inch to the foot.

the water, above a point in each aperture, one-half of an inch distant from the periphery of the wheel; the horizontal lines drawn through these points are shown in Fig. I, Plate IV, by rs, tu, vw, xy, and za'. By adding the vertical distance between the top and bottom of the bucket at any aperture, to the head, found as just described, the head, above the bottom of the bucket, was obtained. The heads thus found are contained in column 4. In a wheel considered at rest, the point corresponding to the bottom of the bucket, at which the water was delivered, would give the first point of action of the gravity of the water upon the wheel; but when the wheel is in motion, this point is generally lower down than the point which we have determined, the distance depending upon the depth of the bucket, and upon the relative velocities of the water and wheel. All the dimensions referred to, are given in feet, and decimal parts of a foot.

Column 5 contains the width of aperture, regulated by the distance to which the gate was drawn, determined in the manner already explained. The openings were increased by determinate differences, until the supply of water was more than sufficient to fill the buckets. The widths of the openings are given in inches and decimals.

The weight raised is given in column 6; this was varied with each head and aperture, until the maximum effect was reached and passed.

The friction, the method of calculating which has been given, for the machine under the particular weight raised, is contained in column 7.

Column 8, is the sum of the weights found in 6 and 7 for the different cases; the numbers represent, therefore, the total resistance overcome by the power. The weights are all given in pounds and decimals of a pound.

Column 9 contains the height through which the several weights were raised, combined with 8, it gives the effect produced.

The time occupied in each experiment is recorded in column 10, in seconds.

By dividing the distance through which the weight was raised, by the number of seconds required to raise it through that distance, the rate per second, or velocity of the weight, was determined. The velocity of the wheel will of course bear the same proportion to that of the weight, as the radius of the wheel to the sum of the radii of the barrel and chain. To avoid any uncertainty in relation to this latter quantity, the ratio was obtained experimentally, by ascertaining the number of revolutions, and parts of a revolution of the wheel, required to raise the weight through a measured distance. The velocities of the wheel are given in column 11.

The weight of water expended in each experiment, determined by measurement of its bulk in the reservoir, is contained in column 12. It was a question, whether in these experiments which would occupy a period extending through a considerable range of temperature, it was necessary to apply a correction for the temperature of the water used, the water expended being measured, not weighed. Calculation showed that no such correction was necessary.*

* The temperature of the water used, was, during the winter, about at its point of maximum density, in the summer, not far from 75° Fahr. Calling the specific gravity of water at 39.38° Fahr. its point of maximum density, unity,

Column 13 contains the head and fall, expressed in feet and decimals.

By multiplying the numbers of column 12, by the corresponding heads and falls from 13, the powers expended were obtained; the numbers expressing them are in column 14. The decimal point is omitted in this and in the succeeding column, as being unnecessary to the determination of the ratio.

Column 15 contains the numbers denoting the effect produced; these were obtained by multiplying the corresponding numbers in columns 8 and 9.

The next column, 16, gives the ratio of effect to power expended, the power being taken as unity.

The maximum effect under each head and width of aperture, is placed in column 17, that reference may be more readily made to the several maxima.

Column 18 contains the velocity of the wheel, which gave the maximum in each case.

The observations made during the progress of the experiments, are recorded in the remaining space.

Two experiments were always made under the same circumstances, when the results of these agreed it was not deemed necessary to make a third, but when they were discordant, a third, and, when required, even a fourth experiment was made to ascertain the point in doubt.

To give the two or three experiments made in each case, would be to add unnecessarily to the space which the tables must occupy: the numbers given are to be considered as so many mean results taken by those who, having been actually engaged in the course of experiment, could duly appreciate the circumstances rendering expedient the rejection of any experimental result. The tables thus become more valuable, by being rendered less voluminous and better adapted to practical use.

The tables will be followed by remarks upon them, and conclu-

the experiments of Haellstroem give for its density at 75.2° Fahr. 0.9976. If we suppose two results are to be compared, one obtained at the minimum temperature of the water, the other at the maximum, they will differ but .0024ths of the greater weight. Thus in a weight of water expended, of 10,000 lbs. the greatest difference could be but 24 lbs., or less than one division upon the gauge-plate, a number which would disappear in the ratio. Take, for example, experiment 15, Table A, which gives the highest number, contained in Part 1st, for the weight of water expended; this number is 4810 lbs.: suppose this experiment to have been made when the water was at its maximum density, and let us ascertain what effect will be produced upon the ratio, if this experiment were supposed to have been made with the water at 75.2° Fahr. The weight of water expended, occupying the same bulk with 4810 lbs. at the maximum density of water, would have been at 75.2° Fahr. 4810 $\times$ .9976, 4798.456 lbs.; this multiplied by the head and fall, 23 feet, gives for the power expended 110364.49 lbs.; the effect, (column 15,) is 91759.4, the numbers in the columns for power and effect in the table are multiplied by ten to avoid placing the decimal point. But 1103645 : 917594 : : 1 : .831, the ratio sought.

The ratio in the table, (column 16,) is .829, differing but .002 from the number just found: the effect, therefore, of neglecting the change of temperature in this extreme case falls only upon the third decimal place, the figure in which place it alters slightly.

sions drawn from them; when necessary, tables will be given presenting condensed views of particular results which are to be compared with each other.

We proceed to give the tables relating to wheel No. I.

TABLE A.—PART I.

CHUTE No. 1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	0.50	257	44.54	301.54	41.5	33	11.84	835	23.0	192050	125139	.652	- -	- -	Water carried above lower centre of wheel before it was discharged from buckets.
2					416	47.32	463.32		40	9.77	1100		253000	192278	.759			
3					463	48.14	511.14		44	8.88	1200		276000	212123	.768			
4					772	53.54	825.54		69	5.66	1825		419750	342599	.816			
5					875	55.34	930.34		74	5.28	2025		465750	386091	.829	.829	5.28	Water discharged at bottom of wheel.
6					931	56.32	987.32		83	4.71	2200		506000	409738	.809			
7					978	57.14	1035.14		86	4.54	2300		529000	429583	.812			
8					1081	58.94	1139.94		94	4.16	2575		592250	473075	.799			
9	2.75	3.00	3.60	1.00	1493	73.85	1566.85	41.5	68	5.75	3450	23.0	793500	650243	.820			
10					1549	76.22	1625.22		70	5.58	3525		810750	674466	.832			
11					1596	78.22	1674.22		72	5.43	3600		828000	694801	.839	.839	5.43	
12					1699	82.59	1781.59		80	4.88	3925		902750	739360	.818			
13	2.75	3.00	3.60	1.25	1905	91.33	1996.33	41.5	66	5.92	4350	23.0	1000500	828477	.828			
14					2008	95.70	2103.70		70	5.58	4550		1046500	873035	.834	.834	5.58	
15					2111	100.07	2211.07		74	5.28	4810		1106300	917594	.829			
16	2.25	2.50	3.10	0.75	875	55.34	930.34	41.5	57	6.86	2115	22.50	475787	386091	.811			
17					1081	58.94	1139.94		69	5.66	2575		579375	473075	.815			
18					1184	60.74	1244.74		75	5.21	2800		630000	516567	.820	.820	5.21	
19					1287	65.11	1352.11		82	4.77	3050		686250	561126	.817			
20					1390	69.48	1459.48		93	4.20	3330		749250	605684	.808			
1	2	4	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE A.—PART II.

CHUTE No. 1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Head of Water above. Top of bkt.	Head of Water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pouns	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	2.25	2.50	3.10	1.00	1184	60.74	1244.74	41.5	56	6.98	2775	22.50	624375	516567	.827			
22					1287	65.1.	1352.11		60	6.51	3000		675000	561126	.831			
23					1390	69.4	1459.48		65	6.01	3225		725625	605684	.835	.835	6.01	
24					1493	73.8	1566.85		70	5.58	3500		787500	650243	.826			
25					1596	78.2	1674.22		74	5.28	3750		843750	694784	.823			
26					1699	82.5	1781.59		79	4.95	4000		900000	739360	.821			
27	2.25	2.50	3.10	1.25	1390	69.4	1459.48	41.5	51	7.66	3300	22.50	742500	605684	.816			
28					1596	78.2	1674.22		60	6.51	3750		843750	694784	.823			
29					1699	82.5	1781.59		63	6.20	3975		894375	739384	.827			
30					1802	86.9	1888.96		68	5.75	4175		939375	783918	.834			
31					1905	91.3	1996.33		71	5.50	4400		990000	828477	.837	.837	5.50	
32	1.25	1.50	2.10	0.50	669	51.74	720.74	41.5	74	5.28	1660	21.50	356900	299107	.838			
33					772	53.54	825.54		84	4.65	1900		408500	342599	.839	.839	4.65	
34					875	55.34	930.34		94	4.16	2150		462250	386091	.835			
35					978	57.14	1035.14		100	3.91	2540		546100	429583	.787			
36	1.25	1.50	2.10	0.75	875	55.34	930.34	41.5	72	5.43	2150	21.50	462250	386091	.835			
37					978	57.14	1035.14		82	4.77	2350		505250	429583	.850	.850	4.77	
38					1081	58.94	1139.94		90	4.35	2600		559000	473075	.846			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE A.—PART III.

CHUTE No.1.—*Gate a. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of Wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Head of Water above. Top of Bkt.	Head of Water above. Btm. of Bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
39	1.25	1.50	2.10	1.00	1081	58.94	1139.94	41.5	68	5.75	2600	21.50	559000	473075	.846			
40					1184	60.74	1244.74		74	5.28	2825		607375	516567	.850	.850	5.28	
41					1287	65.11	1352.11		81	4.83	3100		666500	561126	.842			
42					1390	69.48	1459.48		90	4.35	3400		731000	605684	.828			
43	1.25	1.50	2.10	1.25	1390	69.48	1459.48	41.5	70	5.58	3390	21.50	728850	605684	.831			
44					1493	73.85	1566.85		76	5.14	3650		784750	650243	.828			
45					1596	78.22	1674.22		81	4.83	3825		822375	694801	.845	.845	4.83	
46	0.50	0.75	1.35	1.25	875	55.34	930.34	41.5	62	6.30	2250	20.75	466875	386091	.828			
47					978	57.14	1035.14		67	5.83	2460		510450	429583	.842			
48					1081	58.94	1139.94		70	5.58	2675		555062	473075	.852			
49					1184	60.74	1244.74		77	5.07	2875		596562	516567	.866			
50					1287	65.11	1352.11		88	4.44	3100		643250	561126	.872	.872	4.44	
51					1390	69.48	1459.48		83	4.70	3400		705500	605684	.859			
52	0.25	0.50	1.10	0.75	360	46.34	406.34	41.5	62	6.30	1075	20.50	220375	168631	.765			
53					566	49.94	615.94		93	4.20	1550		317750	255615	.804			
54					669	51.74	720.74		98	3.99	1800		369000	299107	.810	.810	3.99	Water too low to fill the aperture.
55	0.25	0.50	1.10	1.00	772	53.54	825.54		96	4.07	2025		415125	342599	.825			
56					875	55.34	930.34		104	3.76	2275		466375	386091	.828	.828	3.76	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE B.

CHUTE No. 1.—*Gate b. Pitch-back over-shot. Elbow buckets. Close breast. Water let on at upper centre of Wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	0.75	1287	65.11	1352.11	41.5	45	8.69	3000	23.00	690000	561126	.813			
2					1390	69.48	1459.48		48	8.14	3200		736000	605684	.822			
3					1493	73.85	1566.85		52	7.52	3375		776250	650243	.838	.838	7.52	
4					1596	78.22	1674.22		55	7.10	3625		833750	594801	.833			
5					1699	82.59	1781.59		59	6.62	3875		891250	739360	.829			
6	2.75	3.00	3.60	1.00	1699	82.59	1781.59		46	8.50	3925	23.00	902750	739360	.819			
7					1802	86.96	1888.96		48	8.14	4125		948750	783918	.826			
8					1905	91.33	1996.33		51	7.66	4330		995900	828477	.832	.832	7.66	
9					2008	95.70	2103.70		55	7.10	4575		1052250	873035	.829			
10					2111	100.07	2211.07		58	6.74	4850		1115500	917594	.826			
11					2214	104.44	2318.44		60	6.51	5125		1178750	962153	.816			
12					2317	108.81	2425.81		63	6.20	5375		1236250	1006711	.814			
13	1.25	1.50	2.10	1.00	1390	69.48	1459.48	41.5	62	6.30	3400	21.50	731000	605684	.828			
14					1596	78.22	1674.22		71	5.50	3875		833125	694801	.834			
15					1699	82.59	1781.59		74	5.28	4100		881500	739360	.839	.839	5.28	
16					1802	86.96	1888.96		66	5.92	4350		935250	783918	.838			
17	0.75	1.00	1.60	1.25	1287	65.11	1352.11		66	5.92	3235	21.00	679350	561126	.826			
18					1390	69.48	1459.48		71	5.50	3450		724500	605684	.836	.836	5.50	
19					1493	73.85	1566.85		68	5.75	3725		782250	650243	.831			
20	0.50	0.75	1.35	1.25	1081	58.94	1139.94		73	5.35	2775	20.75	575812	473075	.821			
21					1184	60.74	1244.74		78	5.01	3000		622500	516567	.830			
22					1287	65.11	1352.11		84	4.65	3250		674376	561126	.832	.832	4.65	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE C.

CHUTE, No. 1.—*Gate c. Pitch-back over-shot. Elbow-buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	1.00	2008	95.70	2103.70	41.5	69	5.66	4700	23.00	1081000	873035	.808			
2					2111	100.07	2211.07		73	5.35	4900		1127000	917594	.814	.814	5.35	
3					2214	104.44	2318.44		78	5.01	5210		1198300	962153	.803			
4	1.25	1.50	2.10	1.25	1287	65.11	1352.11	41.5	56	6.98	3200	21.50	688000	561126	.815			
5					1493	73.85	1566.85		63	6.20	3580		769700	650243	.845	.845	6.20	
6	1.25	1.50	2.10	1.50	1596	78.22	1674.22	41.5	57	6.86	3875	21.50	833125	694784	.831			
7					1699	82.59	1781.59		61	6.40	4125		886875	739360	.833			
8					1802	86.96	1888.96		64	6.10	4350		935250	783918	.838	.838	6.10	
9					1905	91.33	1996.33		68	5.75	4610		991150	828477	.836			
10	0.75	1.00	1.60	1.25	1390	69.48	1459.48	41.5	77	5.07	3440	21.00	722400	605684	.838			
11					1493	73.85	1566.85		82	4.77	3675		771750	650243	.842	.842	4.77	
12	0.75	1.00	1.60	1.50	1493	73.85	1566.85	41.5	73	5.35	3725	21.00	782250	650243	.831			
13					1596	78.22	1674.22		77	5.07	3935		826350	694801	.841	.841	5.07	
14					1699	82.59	1781.59		81	4.83	4200		882000	739360	.838			
15	0.50	0.75	1.35	1.50	1287	65.11	1352.11	41.5	77	5.07	3285	20.75	681637	561126	.822			Water too low on the gate to fill the buckets.
16					1390	69.48	1459.48		85	4.60	3510		728325	605684	.831	.831	4.60	
17					1493	73.85	1566.85		96	4.07	3825		793687	650243	.819			
18	2.75	3.00	3.60	1.00	1699	82.59	1781.59	41.5	59	6.62	3975	23.00	914250	739360	.809	.809	6.62	Air vents open.
19					1905	91.33	1996.33		67	5.84	4550		1046500	828477	.791			
20					2008	95.70	2103.70		72	5.43	4840		1113200	873035	.785			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Report of the result of experiments made at the United States Navy Yard, Washington City, in order to ascertain the relative strength of rope and chain cables.

The subjoined report was handed to us by Mr. Judge, by whom the experiments were performed. The machine used for the trials was an excellent one, invented by Mr. Judge, and patented on the 29th of November, 1828. A notice of it will be found in the Journal, for February, 1829.

Navy Yard, Washington, 26*th of April*, 1830.

Sir,—Agreeable to your order, I report the following as the results of experiments made in this yard, by order of the Commissioners of the Navy, for the purpose of ascertaining the relative strength of rope and chain cables. Each sample of hemp cable was ten fathoms long when first proved, and six fathoms at second proof. The circumferences were taken before stretched, and progressively until it became dangerous to touch them.

The 1st trial was made on the 10th of April, 1828; when I proved a $16\frac{3}{4}$ inch hemp cable, containing 1215 yarns, averaging $110\frac{3}{4}$ lbs., which stretched 11 feet, reduced $2\frac{1}{4}$ inches, and broke short in the middle with 392 lbs. in the scale; hanging on the index lever. This trial was made under the inspection of captain Stevens.

5th of August, 1829. Proved a 13 inch hemp cable, containing 855 yarns, averaging $114\frac{36}{100}$ lbs. which stretched 13 feet, reduced 2 inches, and broke with 175 lbs. in the scale.

6th of April, 1830. Proved an $11\frac{1}{2}$ inch hemp cable, containing 554 yarns, averaging $124\frac{26}{62}$ lbs. stretched 9 feet, and reduced $1\frac{7}{8}$ inch, when it broke within the splice, with 156 lbs. in the scale; it was spliced and attached to a chain of $1\frac{7}{8}$ inch wire, delivered by Penfield and Taft, when the rope broke in the splice with $190\frac{1}{2}$ lbs.

Proved a 15 inch cable containing 901 yarns, averaging $120\frac{87}{100}$ lbs. stretched 12 feet, reduced 3 inches, and broke abreast of the splice with 227 lbs. in the scale; reconnected to a $1\frac{1}{8}$ chain, made of Peru iron, when the chain broke with 284 lbs. (this link was very short grained;) reconnected the same rope and a $1\frac{7}{8}$ chain of Peru iron, when the rope broke with 336 lbs. in the scale.

Proved a $16\frac{3}{4}$ inch cable, containing 1203 yarns, averaging $142\frac{32}{133}$ lbs. (made by Herron of Norfolk,) which stretched 10 feet 8 inches, reduced $2\frac{1}{8}$ inches, and broke abreast of the splice with 435 lbs.; reconnected to a chain $1\frac{7}{8}$ inch wire, Peru, which broke with 270 lbs. with one strand of the cable; replaced it with a new link, and spliced the cable, it being reconnected, the new link broke with 248 lbs.; then attached the cable to an $1\frac{7}{8}$ chain, when the cable broke with 452 lbs. in the scale.

Proved a $17\frac{3}{4}$ inch hemp cable, containing 1514 yarns, averaging $120\frac{141}{168}$ lbs., stretched 9 feet 8 inches, reduced $1\frac{3}{4}$ inch, and broke clear of the nip with 389 lbs.; spliced and connected to a piece of $1\frac{1}{4}$

chain, of Peru iron, when the rope broke abreast of the splice with 418 lbs. in the scale; the chain was much injured, showing the rope and chain nearly of equal strength.

Proved a $20\frac{3}{4}$ inch cable, containing 1825 yarns, averaging $120\frac{152}{203}$ lbs., stretched 11 feet 10 inches, reduced $2\frac{3}{4}$ inches, and broke short about 7 feet from the splice with 550 lbs.; it was again spliced and attached to Penfield and Tafts $1\frac{9}{16}$ chain, and a piece of Peru chain of $1\frac{1}{2}$ wire, when the rope broke close to the splice with 481 lbs. in the scale.

Proved a 22 inch cable, containing 2236 yarns, averaging $111\frac{213}{250}$ lbs., stretched 14 feet, and reduced $3\frac{1}{4}$ inches. This cable had several trials, in consequence of which it may be thought proper to add 10 lbs. to the greatest weight it bore, which will make the strength of the cable equal to 661 lbs. in the scale, (as will appear by the following statement:)

At the 1st trial, a rivet in the proving chain broke with 553 lbs.; connected, when another rivet broke with 561 lbs. 3d trial, three rivets broke with 651 lbs. I then had the holes reamed and larger rivets substituted, when the cable broke with 557 lbs. which shows that the rope was nearly gone when it raised 651 lbs.

Having respliced the same cable to 6 fathoms, and connected it to a piece of Peru chain of $1\frac{7}{8}$ wire, and a piece of Penfield and Taft's of $1\frac{5}{8}$ wire, the rope broke in the middle between both splices with 437 lbs. in the scale.

Proved a $25\frac{3}{4}$ inch hemp cable, containing 2849 yarns, averaging $124\frac{147}{320}$ lbs., which stretched 11 feet 10 inches, reduced $2\frac{3}{4}$ inches, and broke with 642 lbs. in the scale. This cable was attached to a piece of $1\frac{7}{8}$ inch chain Peru iron, a piece of $1\frac{9}{16}$ Penfield and Taft's, a piece of $1\frac{3}{4}$ English, and a piece of $1\frac{7}{8}$ Ridgly's, with links and shackles from the latter, of 2 to $2\frac{1}{4}$ inches, which broke in the following order:

1st. trial a shackle of Ridgley's broke with		499 lbs.
2nd. do. a 2 inch connecting link	do. do. do.	553 do.
3d. do. a $2\frac{1}{8}$ inch shackle of	do. do. do.	566 do.
Do. do. Penfield & Taft's cracked, not parted	do.	566 do.
4th. do. a shackle of Ridgley's	do.	535 do.
5th. do. Penfield & Taft's	do.	539 do.
6th. do. a shackle of $2\frac{1}{4}$, Ridgley's		473 do.
7th. do. a Peru link of $1\frac{7}{8}$ inch		642 do.
8th. do. the rope broke clear of the splice with one strand at the other end,		571 do.

This cable having so many shocks, and the injury received by the recoil each time the chains broke, it is supposed that adding 52 lbs. to the weight raised at the 7th trial, would have broken it at that time, making the strength of the cable equal to 694 lbs. in the scale.

In conclusion of this report, I would beg leave to suggest the propriety of having the chain cables made larger, as the sizes now made are much smaller than are used by any other nation, for the same classes of vessels. By increasing the size there would be no loss by the chains already made; as the $1\frac{7}{8}$ inch chains intended for 74's are

but the common size for 44's, those for 44's being transferred to 36's, and so on in rotation.

There is another object worthy of consideration, though seemingly trifling still of great importance: In ordering chain iron there is no allowance made for wastage, as the iron when delivered, is but the neat size or what the chain should be when finished; which renders it necessary that the iron should be ordered $\frac{1}{16}$ of an inch larger than the intended sizes of the chains.

A sheet of iron $\frac{1}{32}$ of an inch thick, and $6\frac{1}{4}$ inches wide, will require 15,625 lbs. to tear it asunder, (agreeable to the statements of several authors,) it will therefore be perceived that a $\frac{1}{16}$ loss in the diameter of a chain is of great importance.

Respectfully yours, &c.

(Signed,) John Judge.

Commodore Isaac Hull.

I respectfully submit for your consideration the following table of proportions for hemp and chain cables, and the sizes of iron before made into chains.

Circumference of rope in inches.	Diameter of chain in inches.	Size of iron before made into chains.
$10\frac{1}{2}$	1	$1\frac{1}{16}$
11	$1\frac{1}{16}$	$1\frac{1}{8}$
12	$1\frac{1}{8}$	$1\frac{3}{16}$
13	$1\frac{1}{4}$	$1\frac{5}{16}$
14	$1\frac{5}{16}$	$1\frac{3}{8}$
15	$1\frac{3}{8}$	$1\frac{7}{16}$
16	$1\frac{1}{2}$	$1\frac{9}{16}$
17	$1\frac{5}{8}$	$1\frac{11}{16}$
18	$1\frac{11}{16}$	$1\frac{3}{4}$
19	$1\frac{3}{4}$	$1\frac{13}{16}$
20	$1\frac{13}{16}$	$1\frac{7}{8}$
21	$1\frac{7}{8}$	$1\frac{15}{16}$
22	$1\frac{15}{16}$	2
23	2	$2\frac{1}{16}$
24	$2\frac{1}{16}$	$2\frac{1}{8}$

Respectfully yours, &c.

(Signed,) J. J.

Commodore Isaac Hull.

On the Rapid Movement of Boats on Canals.

A work has recently appeared in London entitled "Remarks on Canal Navigation, illustrative of the advantages of the use of steam as a moving power on canals. By William Fairbairn, Engineer;" which details several experiments made on the Forth and Clyde, Union, Markland, and Androsson canals, manifesting that a high degree of speed may be attained in the navigation of canal boats, without injury to the banks. Some notices upon these subjects have appeared in the public papers, and extracts have been made from the

work in a recent report of the Managers of the Chesapeake and Ohio Canal Company, which are well calculated to arrest the public attention. The subject is rendered particularly interesting at a period when the battle has waxed warm between the advocates of rail-roads and of canals; and should it appear, as the experiments alluded to tend to prove, that boats moving at the rate of ten or twelve miles an hour, produce less agitation in the water, and consequently less injury to the banks than with only a half or one-third of this velocity, an important point will be gained by the friends of canals; we think it improbable that a greater degree of speed than this upon rail roads, although a much greater has been attained, will not be found eligible. "The Ardrossan canal is throughout very narrow; at the bridges and many other places it is only nine feet broad. It has a great number of turns, and many of them are very sudden." On this canal a velocity of twelve miles an hour has been attained by a boat in which there was a steersman and eight other persons; "the boat accomplished a distance of two miles, with one horse, in ten minutes, without any surge, or agitation of the water injurious to the banks."

The summary of the results from the first experiments on the Forth and Clyde canal, embraced three objects worthy of particular notice, as this author very justly affirms: "First, the ease with which the boats were brought up, or stopped, when moving at a high rate of velocity; secondly, the little additional labour, in drawing, occasioned to the horse, when drawing the boat at this high rate, as compared with a low rate of velocity; and thirdly, the apparent diminution of the surge, or agitation in the water, at a high rate of velocity."

Since these experiments, a boat has been regularly "plying between Glasgow, Paisley, and Johnston, on the Ardrossan canal," and carrying "from forty to fifty passengers, at the rate of from nine to ten miles an hour."

The following experiments were made on the Forth and Clyde canal.

"On Wednesday, the 7th of July, the Swift, a boat 60 feet long and 8 feet 6 inches broad, twin-built, and fitted to carry from fifty to sixty passengers, started from Port Dundas, at 16 minutes past 9 in the morning, having on board thirty-three passengers, (all men,) and their baggage. Proceeding through the Forth and Clyde, and Union Canals, she reached Edinburgh at 29 minutes past 4 in the afternoon. She thus made a voyage of 56 miles and a half in the space of 7 hours and 14 minutes. In the course of this voyage, she passed through fifteen locks, eighteen draw-bridges, a tunnel 750 yards long, and over three long narrow aqueducts, and under sixty common bridges, which carry roads over the Union Canal. Her average rate of speed, during the voyage, was nearly eight miles per hour, including every stoppage.

"On the following day, Thursday the 8th of July, the Swift started from Edinburgh, 22 minutes past 9, in the morning, and returning by the same route, with 33 passengers, (all men,) and luggage, she reached Glasgow precisely at 4 o'clock in the afternoon—that is, in 6 hours 38 minutes; going thus at the rate of nearly 9 miles per hour." "On both days the weather was most unfavourable, from

much rain, and a strong gale of wind, directly in her face, having been from the east on Wednesday, and from the west on Thursday." "When free from the locks, tunnel, and other impediments, the speed at which she proceeded varied from 6 to 12 miles an hour; and the extraordinary results of the previous experiments made on the Paisley canal, and Forth and Clyde canal, were again completely verified and ascertained during her progress through 113 miles of canal navigation. For it appeared that when she moved through the water at the rate of 6 or 7 miles per hour, there was a great swell or wave constantly in her front, and she was followed by a strong surge or wave, bearing against the bank of the canal. At these times the hauling rope was tight, and the horses appeared to be distressed. But as the speed was increased, the wave or swelling of water in her front sunk down; and when the speed came to be about 9 miles an hour, the swell entirely disappeared, the waters in front became smooth and level; the hauling rope slackened, and the horses seemed easy, and little or no surge was to be seen on the banks behind the vessel."

On these experiments, the following comment is made by the same writer: "There appears, therefore, no reason to fear, that the banks of canals can ever be hurt, by increasing the speed of boats, to the utmost attainable height; and measures are in progress for increasing the speed of passage boats on the Forth and Clyde canal, and the Union canal; or at least of keeping it, during the whole voyage, between Glasgow and Edinburgh, to the highest rate, which has been already realized; and thus, reducing the time consumed in the voyage, to five hours."

To these experiments, Mr. Fairbairn has added many others which are referred to in the text, and more minutely described in the appendix of his very interesting work; and from them he deduces results confounding all the established theories "that the resistance, to a body, drawn along a line of water confined within the banks of a canal, did not appear to increase in the ratio, laid down in theory; and that, while at a low rate of velocity, viz: at, and under 6 miles an hour, the resistance to the progress of the boat, on a broad line of water, was considerably less than on a narrow line; on the contrary, at a high rate of velocity, say above ten miles an hour, the forces necessary to the propulsion of the boat, on a broad, and narrow line of water, appeared to be the same if the advantage was not rather in favour of the narrow line."

From these observations he was induced "to recommend, and the Forth and Clyde canal company to agree, to build a light twin iron steam passage-boat, to ply between Glasgow and Edinburgh," which, at the date of his publication, he was preparing to launch. "Her length is to be 68 feet, her breadth of beam $11\frac{1}{2}$ feet, her steam engine to be of 10 horse power; the diameter of her paddle wheel 9 feet;" "and its motion calculated to give from 50 to 60 strokes in the minute; her whole weight 7 tons 16 cwt. and her draft of water 16 inches. She will accommodate from 100 to 150 passengers; her anticipated velocity will be from 9 to 10 miles an hour, and the cost

to the canal company, for the conveyance of a passenger, between Edinburgh and Glasgow, 56 miles, will not much exceed 2 pence; which," Mr. Fairbairn adds, "is not a fifteenth of the expense of the conveyance of the same person, at the same rate, supposing it attainable and maintainable by horses."

Mr. Fairbairn says, "that however much he was persuaded that steam power was the cheapest for high velocities, and also for propelling vessels in canals, where the trade was regular, I was not till lately prepared to consider a steam boat, on a canal, as the cheapest, for the conveyance of goods where the trade was irregular, and where the boat had not only to contain a cargo, but at the same time to carry her own engine, and all the conveniences necessary for the application of machinery."

But he proceeds—"Mr. Grahame has lately put into my hands a letter on this subject, addressed to a shipping company, carrying goods along a line of canal 56 miles in length; the calculations contained in that communication are given in the Appendix, and seem to be decisive in favour of steam power. The company, to which this letter is addressed, have to pay for a quantity of horse power, sufficient to deliver 40 tons of goods at each extremity of this line, of 56 miles, every day in the year; besides a spare power employed chiefly in one particular branch of their trade.

The sum they paid for each delivery is one guinea, each way, or at a rate of about one-ninth of a penny per ton, per mile, for the trackage of the goods conveyed. The company, in question, supplying the tracking lines, but, with this addition, the charge for trackage is not increased to one-eighth of a penny per ton, per mile.

"This," says Mr. Fairbairn, "is certainly a small sum whereon to effect a saving by a change of power; but, nevertheless, it appears (from Mr. Grahame's and my own calculations) that not only such saving may be effected, but an additional saving of a large portion of time can be made, by the change from horse to steam power.

"The calculations here referred to make it quite unnecessary," adds the writer, "to say any thing on the subject of *steam power*, as a substitute for trackage, on canals. If *it* be so much cheaper than horses, in the expensive shape of a moving and carrying power, *united in the same boat*, what advantages may not all canals derive from its introduction, in the cheap form of a tug boat, in place of horses?"

In his Appendix, the author adds, "I am the more convinced of the efficacy of steam trackage, above all others, from the circumstance that the train of boats intended to be towed would follow in each other's wake; as the eddy formed by the leading vessel materially lessens the resistance opposed to the succeeding boats." "The small amount of power required to tow a vessel, was remarked by Mr. Grahame in his account of the voyage of the Cyclops, from Alloa to Port Dundas:" "he states, 'when we brought her into the canal, we attached her to the passage boat, and she drew her along the canal 2 miles—1 mile in 14, and the other in 15 minutes. We

then detached her from the passage boat, and did two other miles, but could not save, by this decrease of labour, more than a minute, or a minute and a few seconds, in each mile.' One thing is very evident," says Mr. Fairbairn, "that the introduction of steam, instead of animal power, would dispense with the annual repairs and maintenance of the horse paths; the complaints and delays arising from drivers, horses, &c. would be avoided, and many contingent expenses saved by the introduction of this never failing and very effective agent, as a moving power for the towage of boats on canals."

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks upon Bent Axles and Dished Wheels, in reply to the observations of Mr. J. S. Fry, *of Bristol, England. Published in the Journal of the Institute for May last. Page* 358.

To the Editor: Sir,—If I understand the meaning of Mr. Fry, it appears to me that the positions he has taken are erroneous. He seems to assume that wheels are conical on the face or tread, because they are dished in the spokes, that is, because the spokes are set at an angle with a plane, perpendicular to the hub. This, I conceive, does not follow, and however the construction of wheels may be in England, I am greatly mistaken, if the felloes and tire of all carriage wheels in America are not as truly cylindrical as they can be made, and that no such grinding, as he mentions, takes place in this country.

Where roads are paved, or covered, as they mostly are in England, and present laterally a nearly level surface, it may be less necessary to dish carriage wheels—but, in all countries, where wheels are subject to much side thrust, dishing of wheels outwardly, appears to be absolutely necessary: for, if I understand the subject rightly, in that form consists much of the ability of the structure to sustain the lateral pressure which is always applied to those wheels toward which the load inclines, in proportion as the vehicle is jostled, or conveyed over a side-long track. The spokes being set dishing or conical, they cannot be forced into a circular plane, without bursting the tire, if it be well applied to a well constructed frame. In this, I see no reason for supposing that the tread of the wheel is not perfectly cylindical, as I believe they are, and that they produce no such grinding, or tendency to roll out of a straight line, as the author supposes.

He further says, "it appearing then that the cylindrical wheel only has a natural tendency to roll straight forward, all carriage wheels ought to be so constructed. Consequently, the ends of *the axles ought not to be conical, or tapered, nor bent down.*" He seems to argue, that as cones incline to roll only in circles, that tapering and bent axles incline in the same way, even when the boxes are in like manner conical. If this be his position, I think it an erroneous one. I conceive, of a tapering axle divided into an infinite number

of rings or frustums, and the box or boxes divided into rings or frustums, corresponding to those in the axle, there can be no tendency conceived of, that will cause any part of the axle to encroach upon that part of the box, assigned to any other division. Although rolling cones incline to circles, turning cones have no such tendency that can be conceived of. Hence then it appears that there is no disadvantage, such as he conceives, resulting from the tapering or conical shape of the axle. I now propose to show that it is necessary.

A determinate size of wood or metal is necessary to be assumed in the axle, not only to bear the load intended to be placed upon it, but as the hubs seldom equal in length the radii of the wheels, the side thrust of the vehicle must operate to break the axle at the shoulder, in a correspondingly greater proportion, by the leverage thus acting upon the strength of the axle. The necessary size of the axle at the shoulder being assumed, and as the whole stress of side thrusts being applied at the shoulder, all the size intended to resist that stress may be safely dispensed with at the linch-pin, or point of the axle, where neither the weight nor thrusts act under circumstances to break the axle, the strength of the hub preventing such an occurrence, where the axle and hub correspond throughout. From the principles of wheels and axles, I argue, that it requires less force to overcome the friction of the box upon the axle, where the box and axle are small, than where they are large. Hence, I conclude, that as there is no disadvantage in tapering the axle, it is proper to do so, in order to avail ourselves of this circumstance.

Next and lastly, the bent axle. As wheels are dished, this is necessary, to bring the lower spokes nearly, or quite perpendicular under the weight, and as the axle is pointed, it is necessary to give all the cone shape, or slant to the axle on the upper side, in effect to bend it, in order that the weight of the load may not rest on an inclined plane, which would cause the wheel to press against the linch-pin. As Mr. Fry did not argue this point, I conclude that he conceives a straight axle a necessary feature of a cylindrical one. An axle bent downwards, as is the mode of making them, throws perfectly cylindrical tire upon the outer corner, on a road precisely flat; but upon a convex road, the result is a fairer tread than any cylindrical wheel can have with a straight axle. In neither case is there any tendency imparted to the wheel, to move in other than a straight line. If the handles of a wheelbarrow be held as near the road as the axle, and one raised and the other depressed, the effect will be precisely that of a bent axle; but no tendency will be found in the wheel to move out of a straight line. But if the handles be held further from the road than the axle of the wheel, and the barrow inclined in the same way, the effect will be to change the direction of the track. The reasons appear plain. In the first instance, the axle maintains a direction perpendicular, or directly across the track; but in the last instance, the elevation of the handles occasions the inclination of the vehicle to throw the axle not only out of its level position, but out of its straight direction.

I conclude, that axles bent backwards, incline wheels outward, so when the axles are bent forwards, the wheel will incline inwards. Were axles constructed in this way in a small degree, that is, tapered a little more behind than before, they would rarely run off, even were no nut nor linch-pin used; but this would incline the wheel to grind, as complained of by Mr. Fry, in the same small proportion. Axles, however, bent directly upward or downward, I conceive to have no such tendency from rolling merely.

I am not about to enter upon a disputation with Mr. Fry or any other person. I hope, however, to elicit the remarks of those who have a greater share of scientific and practical knowledge of the subject than myself. Respectfully,

Jno. S. Williams.

Washington, Mason county, Ky., June 12th, 1831.

Description of Ebenezer A. Lester's *Pendulum Steam Engine.*

We have been furnished by Mr. Lester, of Boston, with impressions from the engraving of his pendulum steam engine, together with a pamphlet containing his views upon the subject, and the testimonials of its satisfactory performance from those who have had the instrument in use. From this pamphlet we shall make such extracts as may appear to us sufficient to give a clear idea of the whole, accompanied with such remarks as may suggest themselves in relation to it. If in so doing we dissent from Mr. Lester in some of his theoretical opinions, we wish it to be most distinctly remembered that these differences of opinion have nothing whatever to do with the goodness of his engine; this is a question of practice entirely, the engine has been in use for a considerable length of time, and has given entire satisfaction to those who are well able to form a correct judgment respecting it, and who have no interest to promote but that of truth.

Mr. Lester does not lay claim to the invention of the vibrating cylinder engine, but only to that modification of it which he describes under the name of the pendulum engine. He observes that "In the application of steam power by machinery, it has been the object of all inventors, from the time of Watt to the present, to direct the power of the steam, in the first place, to the production of a rotary motion, and thence to take the motion adapted to produce the effect intended. The material question then, in regard to any plan of a steam engine, is, whether it is well calculated to produce a rotary motion, and that is the best, which gives such a motion in the most direct and simple manner. The pendulum engine is proposed as possessing very important advantages in all the particulars above mentioned."

In a note appended to this paragraph, he makes the subjoined observations respecting the principle upon which the power of steam engines is sometimes estimated, and on the relationship which exists between the boiler and the engine.

"In relation to steam engines, about which so much has of late been said and written, I will here make a suggestion respecting the estimate of the *power* of an engine, in regard to which, there is a great deal of obscurity, and uncertainty, both in contracts and in speculations on the subject. In estimating the power of an engine, for instance, as being equal to that of a certain number of horses, only the diameter of the cylinder and length of the stroke are sometimes given, without taking into consideration, the force of the steam and rapidity of motion, with which the engine is calculated to operate; for it is apparent that doubling the rapidity of the motion of the piston, with the same force of steam to the inch constantly acting upon it, will double the power of the engine, as much as doubling the surface of the piston on which the steam acts, supposing it still to act with the same force upon the square inch. It is evident that the largest cylinder, without an adequate supply of steam, will not make a powerful engine; and on the other hand, that a comparatively small cylinder, with a high pressure of steam, and running with great velocity, would make a powerful one. In estimates of this sort, we must, therefore, take into consideration the extent of the surface of the piston on which the steam acts, the degree of pressure of the steam to the square inch, and the rapidity of the motion of the piston.

"It is a popular error, also, not to distinguish sufficiently, the engine from the boiler, or generator, which is, in fact, as distinct from the engine, as the strength of the mechanic is from the tool with which he works. It may, therefore, not be superfluous to apprize persons, not conversant with steam enginery, that the remarks made above, on the pendulum engine, apply to the engine as distinct from the boiler or generator."

That the errors above alluded to have appeared in the estimates and calculations of individuals is indisputable, but we are not aware that they have prevailed to any extent, nor do we perceive how it is possible that they should do so excepting in the minds of those whose acquaintance with the steam engine is extremely limited. We have always considered the area of the piston, the length of the stroke, the number of strokes per minute, and the elastic force of the steam, as the necessary and usual elements in estimating the power of an engine; and although much which has appeared upon the subject has been very loosely written, the published investigations which embrace it in all its bearings are voluminous. The boiler, or generator, is the very soul, the animating principle, of the steam engine. All the *essential* difference in principle between the low and high pressure engines resides in the boiler, and provided the parts of the engine have sufficient strength, all that is necessary to convert the low into the high pressure engine, is to neglect the condenser, and to increase the fire, so that steam of a higher temperature and greater density may be produced in a given time.

Many of the subsequent observations made by Mr. Lester apply to the vibrating cylinder engine in general, whilst others are more particularly appropriate to his modification of it. The vibrating cylinder has been generally suspended upon trunnions, at or near its

middle; the cylinder has also been placed both vertically and horizontally. The peculiar feature of Mr. Lester's engine is the placing of the trunnions upon which it is suspended, and through which the steam is supplied, at the upper end of the cylinder, in order to give it a tendency to vibrate as a pendulum, from which circumstance its name has been derived. Mr. Lester observes, that "One advantage of the pendulum engine is obvious, not only to a mechanic, but to any person not at all skilled in mechanics, on the first inspection of the engine, or even a print of one, namely, the application of the power by connecting the piston rod *immediately* with the crank pin. Here the lever beam, connecting rod, and all the gearing and apparatus of whatever kind, interposed between the piston rod and crank pin, in fixed engines of all descriptions, is at once dispensed with. The cost of maintaining this gearing is thus avoided. This part of the machinery, in fixed engines, is, as every practical engineer well knows, very liable to get out of order, and the engine must occasionally be stopped to repair it. This inconvenience is also saved by the pendulum engine. And then, this gearing or intermediate machinery, in some fixed engines, as, for instance, an engine standing on end, and working upwards by a connecting rod, constantly opposes the motion of the crank, by its gravity, except at the dead points, when the connecting rod is precisely perpendicular. The resistance from this cause is not great, but whatever it may be, it is saved in the pendulum engine. Again, this intermediate gearing is liable to friction, which is a constant impediment that must be overcome by a constant expenditure of power for this purpose. The pendulum engine avoids this impediment. By considering how much power would be requisite to keep this intermediate gearing and machinery of a fixed engine in motion, precisely as it moves when the engine is in operation, some estimate may be formed of the saving of power, made in this particular, by the pendulum engine. This single advantage of that engine, unless it is offset by some important disadvantage, will, the inventor apprehends, be a sufficient ground for a decided preference of it. But it has other advantages which are conceived to be of much greater importance."

In producing a rotary motion from the piston rod of a fixed cylinder, the action of the rod, excepting at the dead points of the crank, is never direct, the bar which connects the piston rod with the crank, always tends therefore to force the piston rod laterally; to prevent this effect, slides, or parallel rods, are provided, upon which a portion of the power is expended. Power is consequently lost both from the angular action upon the crank, and the friction arising from the lateral pressure. "When the connecting rod is three times the length of the crank, (which has been considered by machinists a safe proportion of these parts,) the saving of power, made merely by its direct application in the pendulum engine, is 16 2-3 per cent. When a longer connecting rod is used for the fixed engine, the difference will be less. The connecting rod and crank are, however, very frequently about in the above proportion in fixed engines. This saving is a matter of demonstration by the easy and ordinary process of the

resolution of a force, indirectly applied, into the two parts—that which is lost, and that which takes effect. For this superiority of the pendulum engine, therefore, I have only to refer to lines and figures, and a familiar principle in mechanics."

With a fixed cylinder, if the cylinder itself, the stuffing box through which it passes, and its connexion with the slide, or beam, do not all perfectly coincide, there is, consequently, a continued tendency to bend or break the piston rod; and where the strength is such as to resist this, there is yet a great wear of the rubbing parts, and a considerable loss of power. The pendulum engine being to a considerable extent exempt from this lateral pressure, appears by the certificates given, to require packing only one-fourth as often as the ordinary fixed engine.

The tendency of the pendulum engine to a vibratory motion, the inventor states, gives to it a manifest superiority over the ordinary vibrating cylinder, hung upon its centre; the whole tendency of the latter, when put into motion, being to a continuance of it in a circle; whilst the former, obeying the law of gravitation, always tends to a vibratory motion. Mr. Lester, in his description, enters into some estimates founded upon the length of the pendulum which vibrates seconds, (39⅛ inches,) and that of a pendulous cylinder which should vibrate in the same time, intended to exhibit the advantages resulting from this structure. His calculations upon this point are necessarily somewhat vague, as, from the attending circumstances, they do not, in fact, admit of any thing like precision; he observes that "In regard to gravity, the cylinder of the pendulum engine will represent a pendulum of a little less than two-thirds of the length of the cylinder of the engine, so that a pendulum engine, of which the cylinder is four and a half feet in length, will, as far as gravity and oscillation are concerned, represent a pendulum of 30 to 36 inches in length. As such a pendulum vibrates seconds, it follows that an engine of which the cylinder is four feet and a half in length, will perform 30 to 35 revolutions in a minute, without the least disturbance or impediment from its gravity; and an engine, of which the cylinder is twenty-seven inches in length, will perform somewhere about 50 or 60 revolutions a minute, without any obstruction from this cause. To this degree there can be no question that gravity concurs perfectly with the motion of the cylinder of the pendulum engine. But it appears from the facts stated in relation to the engines already in operation, that it may be run at double this velocity at least, to advantage. The engineer of the pendulum engine at the Navy Yard in Charlestown, from observing the action of the engine, estimates that it might be advantageously driven a hundred revolutions a minute. This allows of a greater velocity than that at which a fixed engine can be driven without endangering its gearing."

The difference between a pendulum of 30 inches, and one of 39⅛ inches, is too great to admit of the conclusion that they each vibrate seconds. We speak of this only as a matter of calculation which does not do much towards establishing the point insisted upon; and indeed it is admitted both by Mr. Lester and those who have used

his engine, that the rapidity of its action may vary greatly from that of its natural vibration, without any apparent inconvenience; and such we should have anticipated would prove to be the case. Were the fact otherwise, we should view it as a serious disadvantage, as the number of vibrations made in a given time, cannot, in the working of a steam engine, be rendered uniform under the varying circumstances of its application.

"Another advantage in the plan and construction of this engine, remaining to be mentioned, arises from its working in a frame, the parts of which always maintain the same relation to each other, and, as it has in its operation no tendency to displace any fixtures or disturb the foundation, a great expense is saved in these respects, in putting up the engine, more especially in places where it is difficult to get a good foundation. The pendulum engine only requires a foundation sufficient merely to support the *weight*, without any necessity of providing for extraneous resistance to the action of the machine itself, as in the case of a fixed engine."

"On this engine being first put into operation, a query was suggested whether it would have a greater tendency, than a fixed engine, to wear the cylinder ovaling or untrue. I felt great confidence from the first that it would not prove to be liable to this objection, and experience has fully shown, as will appear from the certificates annexed, that with any reasonable skill and care in keeping it packed, it will wear perfectly true, which is not always the case with fixed engines, even with the greatest attention of the engineer. So far, therefore, from there being any objection to it in this respect, it might be enumerated as one of its advantages, that it is less liable to wear the cylinder unequally, than a fixed engine; though there is no doubt that an engine, on this, or any other plan, may wear the cylinder unequally in case of gross negligence in keeping it packed."

"As practical application and use are the true tests of all machinery, I have requested some persons who have been acquainted with the operation of this engine, to make statements of the results of their experience and observation. Their statements are annexed. They are made by persons who have no interest whatever in obtaining for the machine a better reputation than it merits. Some of them are persons of mechanical science, others are practical engineers; and a number of them are sufficiently well known to the public, to insure confidence in their statements and opinions."

We cannot insert the whole of the certificates in consequence of their great length; we therefore make an abstract from them, containing what relates particularly to the action of the engine.

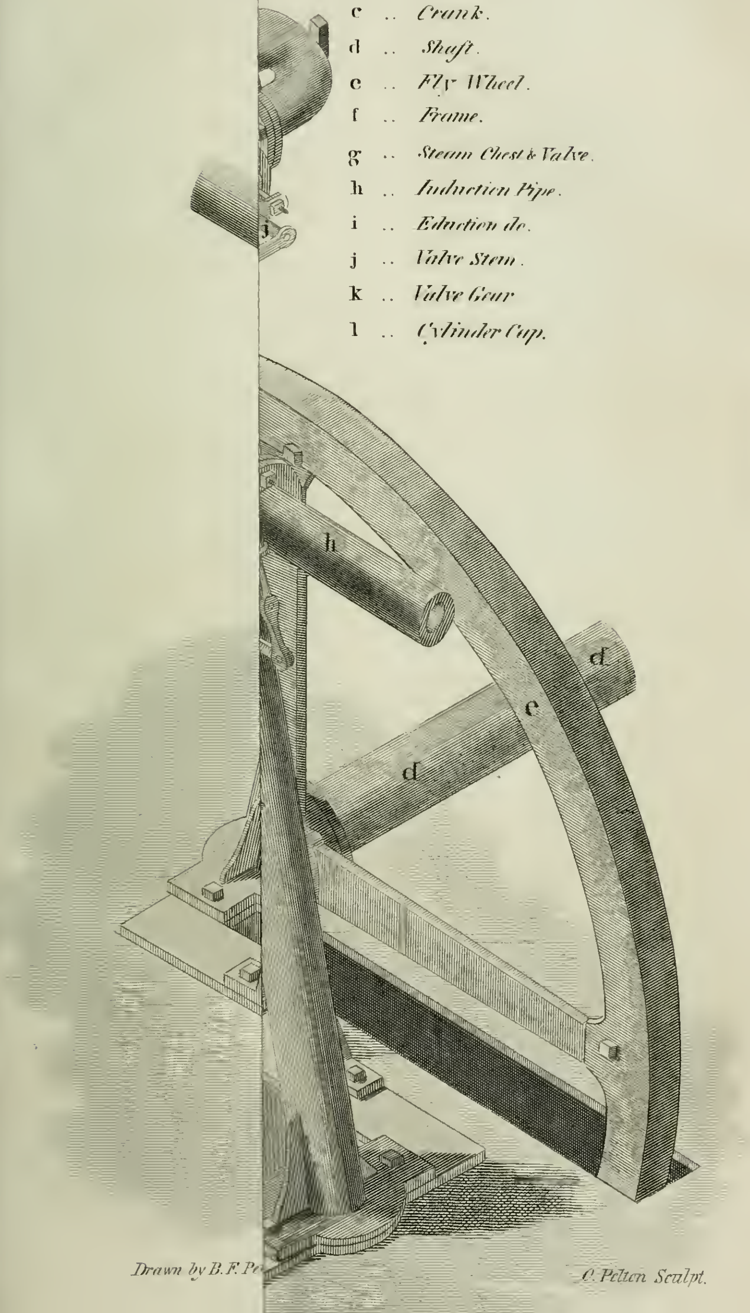
CERTIFICATES.

NOAH BUTTS, Engineer of the Navy Yard, Charlestown, states that one of Mr. Lester's engines had been used by him for two years; that he had found it greatly superior to those on the old plan; requiring packing much less frequently, and keeping in order much longer. That it had no tendency to wear oval. The engine has a nine inch cylinder, and a twenty-eight inch stroke. It has run about 16 hours

LE|EAM ENGINE

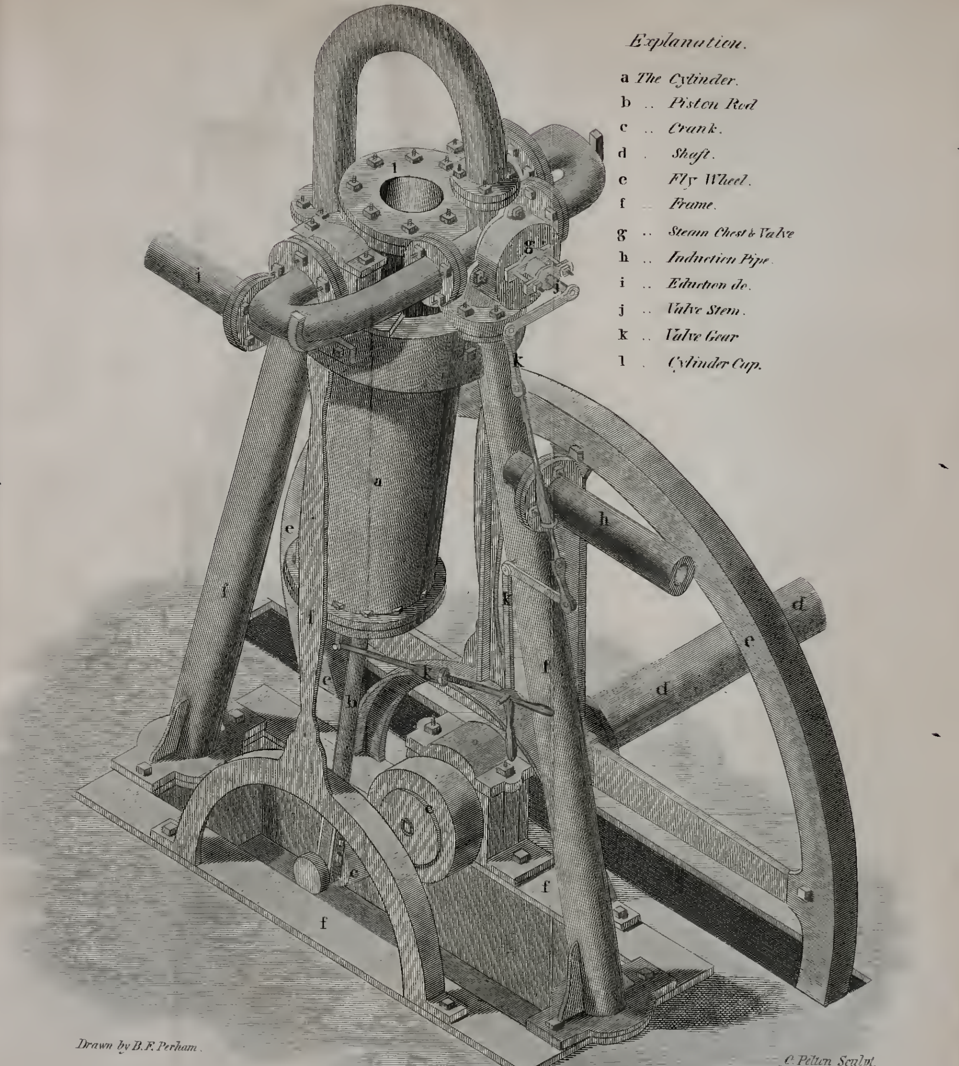
Explanation.

a *The Cylinder.*
b .. *Piston Rod.*
c .. *Crank.*
d .. *Shaft.*
e .. *Fly Wheel.*
f .. *Frame.*
g .. *Steam Chest & Valve.*
h .. *Induction Pipe.*
i .. *Eduction do.*
j .. *Valve Stem.*
k .. *Valve Gear*
l .. *Cylinder Cup.*



Drawn by B. F. Pe *C. Pelton Sculpt.*

LESTER'S PENDULUM STEAM ENGINE



Drawn by B. F. Perham.

C. Pelton Sculpt.

per day; at times it has worked six pumps and driven four lathes for turning iron, &c. and two grind stones. Two of the pumps lift a column of about forty feet each, weighing about a ton. The four smaller lift 16 feet, the column of each weiging about 200 lbs. The stroke of the large pumps about 33 inches; those of the smaller 24. The strokes of the pump as compared with those of the engine, are as 7 to 25. The boiler is 18 feet long, and 3 in diameter. The usual pressure from 20 to 30 lbs. per inch.

L. BALDWIN, Esq. Engineer of the Dry Dock, Charlestown Navy Yard, says:—" The engine was first set to work in May, 1828, and has ever since been daily used in pumping water from the foundation of the dock. No part of the machinery has given way, nor has the engine failed to do all the work which was required. It has, in every respect, answered my expectation, and were I to engage in a similar undertaking, I would obtain a similar engine for the same service. Its simplicity and compactness render it peculiarly adapted to constructions like the dock, where a slight and temporary foundation only can be had. I have always viewed its operation with peculiar pleasure, and am convinced that it has been more economical than any other engine of the same power I could have procured. I regret I had not procured one like it for draining the works of the Norfolk Dock in Virginia.

ALEXANDER PARIS, Superintendent of the Dry Dock, certifies to the facts before stated, and to the general excellence of the engine; and a similar certificate is given by eight other persons employed there.

From the Woollen Manufactury of BENJAMIN BUSSEY, Esq., in Dedham, there are several testimonials of its goodness. After a long and fair trial its parts were all in excellent order, and it did not require packing more than three or four times a year.

" *Extract of a letter from the Rev. Enoch Burt, of Manchester, Conn. dated June* 11, 1830.

It is now six months since I have had your pendulum engine in operation. It works well. From a practical as well as scientific acquaintance with the various engines now in use, I, at the first examination, (viz. at the Dry Dock in Charlestown,) pronounced it in my own mind vastly superior to any other plan, and from operating it for six months, (during which time it has rever been repacked,) in my manufactory, I am fully confirmed in my opinion of its superiority; it is, you know, only a four and a half inch calibre, 18 inches stroke, and I run it but 35 revolutions per minute: (it would be adviseable to run it much quicker, but this speed is best for my work,) and with steam at about 25 lbs. per inch, it drives my fulling mill, calender, shearing and drying machines, and raises the water for the works by a pump of 4 inch calibre and 9 inches stroke, from a

well 25 feet deep. I have run it three days with one cord of 2 feet wood, (oak,) which is sufficient. The simplicity of it is admirable. It exhibits all its parts in operation at a single view. I have no trouble in keeping it tight and in order—and I do not hesitate to say that it will, with a given quantity of steam, produce an effect 20 per cent. greater than can be produced in one of the same size stationary cylinder. This arises from the great diminution of friction, by the direct application of the power to the crank. It runs perfectly smooth—no noise—and with proper attention no way liable to get out of order. Those who want steam power, need only make themselves acquainted with the pendulum engine to give it at once a decided preference to every other kind now in use—for it only wants to be known to be preferred, and this is the engine that is fitted, from its construction, (and the only one,) for rail-roads. I need not wish you great success in introducing it; the intrinsic excellency of the invention must insure it. If my opinion is of any service to you in forwarding its introduction, you are at liberty to make what use of it you think proper.

Yours, &c.

E. Burt."

Mr. E. A. Lester.

The accompanying plate, with the references thereto, exhibit with sufficient clearness, the general structure and arrangement of the engines.

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, June 23, 1831.

Mr. Samuel V. Merrick was appointed chairman, *P. T.* and Mr. Frederick Fraley, Recording Secretary, *P. T.*

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Howell Hopkins, Esq.

The Gentleman and Cabinet Maker's Director, being a collection of the most elegant and useful designs of Household Furniture, 1762.

By Messrs. Carey & Lea.

The nature and properties of the Sugar Cane, with practical directions for the improvement of its culture, and the manufacture of its products, by G. R. Porter.

By Messrs. G. & C. & H. Carvill, New York.

Treatise on the Steam Engine, by James Renwick, LL. D.

A Compendium of Mechanics; or a Text Book for Engineers, Millwrights, &c. by Robert Brunton, with additions by James Renwick, LL. D.

By Mr. R. S. Gilbert.

The Cabinet of Natural History and American Rural Sports, No. 6, vol. 1st.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

London Journal of Arts and Sciences, for May, 1831.

The Repertory of Patent Inventions, for May.

The Mechanics' Magazine, for April.

The Register of Arts and Journal of Patent Inventions, for May.

The Journal of the Royal Institution of Great Britain, for May.

Recueil Industriel, for January.

Bibliothéque Physico-economique, for March.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for December, 1831.

American Annals of Education and Instruction, for June.

The American Quarterly Review, for June.

The Ladies' Book, for June.

Museum of Foreign Literature, Science, and Arts, for June.

The committee on Inventions presented their reports on the following subjects, viz:

On Mr. Thomas Earle's improved Steam Boiler.

On Mr. Charles Thompson's machine for making Window sashes.

On Mr. Ebenezer Whiting's machine for cutting Bungs for Casks.

Which were read, and on motion referred to the committee on publications, with power to publish.

George W. Smith, Esq. to whom was referred the question—

What is the best unguent, and the most economical mode of its application, to diminish the friction of rail-way cars, locomotive engines, and other machinery of similar construction; stated, that the results of several experiments which have recently been made, have led to the conclusion, that the finest quality of sperm oil most effectually relieves machinery from the effects of friction. As the experiments, above alluded to, were still under consideration, and others about to be tried, to test the correctness of the conclusions already drawn, he requested that the consideration of the question should be named for discussion at a future meeting; and assured the meeting, that as soon as the decision of the final experiments should be known, he would lay the results before the Institute.

Professor A. D. Bache remarked, that Mr. Wood's experiments on the friction in rail-way carriages, had shown the fact to be in that case, as stated by Mr. Smith, and that those of Rennie led to the conclusion, that the nature of the unguent should bear some relation to the weights to be supported, or resistances to be overcome, the more fluid unguents applying best to light loads.

After which Mr. J. M'Ilvaine stated, that in using the various kinds of unguents on his machinery, he had come to the same conclusion as that stated by Mr. S. that the best quality of sperm oil was the most beneficial; having considered it as a question of much importance, he had devoted a considerable time to the subject, and was very particular in making his observations. He further

remarked, that the oil should be carefully cleansed, and deprived of those parts which water could remove.

SAMUEL V. MERRICK, *Chairman.*

FREDERICK FRALY, *Recording Secretary, P. T.*

REPORTS

Of the Standing Committee, appointed by the Franklin Institute, to examine the merits of such inventions or improvements as may be submitted to their consideration.

On a Machine for Cutting Bungs for Casks, &c. by Mr. EBENEZER WHITING.

THE committee on inventions, to whom was referred the consideration of Mr. Whiting's bung cutter,

Report, That in the opinion of the committee, the very compact and simple machine of Mr. Whiting is eminently calculated to answer the purpose of its invention. They find that it consists of a shaft six or eight inches long, to be fixed in the mandrel of a lathe. In the other end of the shaft is a pin capable of retreating against a spiral spring, within a cylindrical cavity at its axis. On this shaft, at convenient distances, are two transverse staples, in one of which is a joint of the cutting part of the tool, while the other (nearer the cutting end) serves as a guide to the cutter, in its movement about said joint. The cutting part is kept at a proper distance from the shaft by a spring between the two, admitting, however, sufficient motion to give the conical form to the bung.

From the specimens of its work which accompanies the description, there exists no doubt in the minds of the committee, of the entire adaptation of this machine to its intended purpose, and they feel entire confidence, that brewers, distillers, and others having occasion for a large number of cask bungs, will find their interests promoted by using Mr. Whiting's machine.

On a machine for making Window Sashes, by Mr. CHAS. THOMPSON, *Poughkeepsie, New York.*

THE Committee on inventions to whom was referred the consideration of Mr. Charles Thompson's "Machine for making Window Sashes,"

Report, that the committee have examined with care the models accompanying the specification of this machine, and that they have seen specimens of window sashes stated to have been made by the machine as now in operation on a large scale.

The "machine for making window sashes," as seen in the models before the committee, is in fact a series of no less than eight independent machines, to each of which, motion is communicated by any

convenient mover, through bands and pulleys, and thence, when necessary, through cranks, tangent screws, and cog wheels. The operations of sawing off, slitting, cutting tenons, making monions, and dovetails, are all performed by circular saws, furnished with suitable carriages and supports for the stuff on which these several operations are to be effected.

The cutting of grooves is performed by cutters revolving in the manner of circular saws.

The planing, ovoloing and rabbeting, are executed by suitable planes, moving with alternate motion in a convenient frame, in connexion with a fly wheel intended to produce regularity of action.

The mortising and coping are also performed by the alternate vertical motion of chisels, acting on the pieces placed upon supports, or carriages, beneath them.

The boring of holes for all the pins in the completed sash is effected simultaneously by a number of bits, moved by pulleys, connected by a common band, and placed in a frame which serves the additional purpose of pressing up, tightening, and giving the true rectangular figure to the sash.

The committee discover in the several machines an ingenious application of established principles and devices in mechanics, each apparently well suited to discharge the office which the inventor has assigned to it.

The very nature of the work to be performed implies the necessity of various and somewhat complicated machinery; but the committee do not find any part which, in the extensive operations of the machine, could be advantageously dispensed with.

The machine for cutting tenons is furnished with an apparatus for reversing the motion of the endless chain which carries the piece to be cut, and also with an arrangement for varying the speed of said chain. These parts, though not constantly employed, may probably be found useful, the former, to facilitate the removal of a piece whenever, by accident, the saws become clogged, and the latter to accommodate the amount of work to be done in a given time to the state of the saw teeth, and to the thickness and condition of the timber.

The committee feel assured that the machines now exhibited in model, may be found capable, if well constructed in working size, and adequately superintended, of executing a large amount of sashes in a day, and of diminishing the expenses of building, which, in rapidly growing towns and cities, and in newly settled districts of our country, is frequently no inconsiderable obstacle to the progress of improvement.

The work presented from the manufactory at Poughkeepsie was free from blemishes, and highly satisfactory in point of stability.

The committee can cheerfully recommend this machine to the attention of builders.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *washing Gold Ore*, and alluvial auriferous earth; John Powell, Salisbury, Rowan county, North Carolina, April 1. Granted in pursuance of a special act of Congress, passed February 12th, 1831; the applicant not having resided two years in the United States.

The washing in this machine is to be performed in a large shallow bowl, which is best formed of cast iron. For ordinary machines this bowl may be three feet in diameter, and one foot in depth. The inside is to be turned perfectly smooth, and at the bottom of it a cup-like cavity is to be turned, which may be three inches in diameter, and half an inch in depth. This bowl is to be placed on a vertical shaft, and is to receive a rotary motion, by means of a crank, and bevel gears. The ore, or earth, to be washed, is placed in the bowl, to which water is supplied in any convenient manner. When caused to rotate, the centrifugal force will throw the water, with the stones and light earthy matter, over the edge of the bowl, whence they fall upon an inclined plane, and are conducted off. The gold, with the heavier species of sand, and particles of plumbago, collect, from their superior specific gravity, in, or near, the cup at the bottom of the bowl. Mercury is sometimes to be used for the purpose of amalgamating the finer particles.

Some rakes and scoops are described, which are necessary auxiliaries in the process of washing.

The whole machine is considered as new, no claim being made to any of its particular parts, or to their arrangement.

---

2. For an improvement in the *Thrashing Machine;* Gideon Cande, and Joseph Tousey, Rochester, Monroe county, New York, April 1.

The beaters consist of iron bars let into grooves, or spaces in a cylinder, and extending from end to end. The hollow segment consists of bars each fixed in separate slots in end pieces, and borne up to their places by means of spiral springs.

The claims are to "the manner in which the iron bars, or beaters, are constructed and attached to the convex cylinder; and the manner in which the ends of the bars in the concave cylinders are fixed, so that each iron bar may recede, as grain or other objects which enter the machine make it necessary.

---

3. For a machine for *making Wood Screws;* Hazard Knowles, Colchester, New London county, Connecticut, April 1.

A machine to manufacture wood screws, is, of necessity, one of considerable complexity, as is evinced by all the machines for this

purpose which have been patented both here and in England. In the present instance the specification and references to the drawings occupy nearly thirty pages of foolscap paper; the description has evidently been given with great care. There is no claim made, which is to be regretted, as there must necessarily be some parts common to this and other machines for the same purpose. We do not think it necessary to attempt an explanation of the structure of that now patented.

---

4. For *applying the Circular Saw to the cutting of Laths;* Chaning Madison, Miamiesburg, Montgomery county, Ohio, April 4.

The patentee says, "My claim to the invention of this lath machine, consists in the application of the circular saw to the cutting of lath off slabs at saw mills, as before mentioned."

We are very apprehensive that a claim to the application of the circular saw to the cutting of laths, would not be tenable, even if the thing had never been done, as the saw has been long in use for sawing strips in general; but its particular application to the sawing of laths has been before patented. There must, therefore, be some novelty in the construction of the machine upon which to found a valid claim.

---

5. For *improvements in Metallurgical operations* for accelerating and improving the manipulations in general, with the use of anthracite coal in particular; Richard Wilcox, Patterson, Essex county, New Jersey, April 6.

This is the first of a series of three patents, all tending to the same end, as being parts of a general system for the reduction of metallic ores, and particularly that of iron.

The second patent has the following title.

---

6. For *improvements in Metallurgical operations*, by the introduction and adoption of chemical agents which prevent the ores from oxidating, or volatilizing, either from a redundancy of caloric evolved during the fluxing of the ores, or the deleterious action of the gases, either in blast, reverberatory, or cupola furnaces or forges, &c. Together with further improvements in divers sorts of furnaces, cupolas, &c., April 5.

The third patent is—

---

7. For *improvements in Metallurgical operations*, in the manipulation of metals in general, with bituminous coal, charcoal, coke, wood, peat, &c. April 5.

The series occupy forty well filled pages, and furnish an essay on metallurgical operations, rather than a mere detail of the improvements claimed, and such other matter as might be necessary to ren-

der the nature of these improvements clear and intelligible. The drawings contain 21 separate representations of furnaces in section. To give an analysis of these patents would demand more time and space than we can afford. In the first there are six leading improvements claimed. *First.* The concentration of heat, by the construction of the furnaces, as exemplified in the drawings. *Second.* Separating the ore from the coal, or any other combustible matter, and preserving them separate from each other during the manipulations. *Third.* Separating the metals in a lower or secondary reverberatory furnace, or furnaces, sometimes preserved at a regular and uniform temperature by additional fires. *Fourth.* Employing in this system not merely anthracite, but other kinds of fuel, and using not reverberatory only, but other kinds of furnaces. *Fifth.* Dispensing with the large quantity of oxygen gas which is usually forced into furnaces when the ore is in fusion. *Sixth.* The reducing the iron to a malleable state at one operation without exposing the cast iron to the injurious effects of the oxygen contained in the atmosphere.

The second specification describes the modes in which a combination of sand and clay is to be used in the furnaces, which mixture is to form a covering, or flux, to protect the ore and the fused metal from oxidation, volatilization, &c. and likewise the structure of the furnaces used by the patentee; the principle upon which these are constructed, it is stated, may admit of numerous modifications: the general principles, or modes of operation, however they may be modified, are claimed as the objects of the patent.

The third specification principally points out modifications in the manipulations, and furnaces, adapting them to the use of fuel other than anthracite.

The intelligence displayed in the general contents of these specifications inspires a belief in the value of the system adopted. This is no place for a critique upon the theoretical parts of the instruments before us, many of which, although they evince some acquaintance with chemistry, are very far from being invulnerable. If the processes are good, these mistakes are of little practical importance, and we name them principally for the purpose of stating that a specification of an invention, or discovery, is not an instrument of reasoning, but of description merely; that its object is to inform us how, rather than why, a particular thing is done. There are but few of those specifications which extend to twenty or thirty pages, as many do, which might not present every thing that is new, and requisite, in less than one-fourth of the space, and with more advantage to the public. We are fully aware that the aim of those who draw them up at such length, is to give in full detail every thing which appears to them to bear upon the subject, and that although unnecessarily long, the motive for making them so is praiseworthy.

---

8. For a *Washing Machine;* Miller D. Mulford, Bloomfield, Ontario county, New York, April 5.

This is a box, or trough, hung upon gudgeons, and which is to be

rocked by hand. Notwithstanding the magnificence of this invention, there is no claim made to any part of it.

---

9. For a *machine for Thrashing and Cleaning Wheat* and other grain; Samuel Lane, Hallowell Kennebeck county, Maine, April 6.

(See specification at p. 270. vol. vii.)

---

10. For an improvement in *Fuel for manufacturing Malleable Cast Iron;* Seth Boyden, Newark, Essex county, New Jersey, April 6.

"The improvement consists in applying peat, or turf, as a substitute for bituminous coal, in manufacturing malleable cast iron, as described in a patent granted to me the 9th day of March, 1831. The improved fuel, or composition of peat and rosin, pitch, or tar, is free from the injurious effect of the sulphur contained in the bituminous coal. SETH BOYDEN."

We have, as in the specification referred to, given the whole of the matter contained in the description of the patentee.

---

11. For *Glass Frames for Pictures, Looking Glasses, &c.;* John Scott, Philadelphia, Pennsylvania, April 6.

This patent is taken for a frame made of glass, whatever its form may be, and whether made in one or more pieces. Some century since, it was the common fashion to make looking glass frames out of glass variously cut, and ornamented. We are compelled, therefore, to place this patent among the *modern antiques*, where it will find many companions.

We have no doubt that the patentee prepares his frames in better taste than those made by our great grandfathers, and had his claim been confined to any new and improved method of construction, it might have been good; at present it is certainly too broad.

The drawing is without written references.

---

12. For an improvement in the *method of Washing Rags in the manufacture of Paper;* John Ames, Springfield, Hampden county, Massachusetts, April 6.

(See specification.)

---

13. For an improvement in the *Scoop Shovel;* Elisha Mudge and Rufus Tenny, Alexander, Genessee county, New York, April 6.

A piece of plank is taken which forms the back end of the scoop; a piece of sheet iron forms the bottom and sides of the shovel, and is to be nailed on to the edges of the plank. A handle, 2 feet 3 inches long, is to be attached to the plank, and properly secured and

braced. This constitutes the whole of the *conjoint invention* of the patentees. There is no claim, and no references to the drawing.

---

14. For an *apparatus for preventing the Bursting, Collapsing, or Burning of Steam Boilers;* William A. Turner, Washington county, North Carolina, April 6.

This specification describes modes of operation analogous to those contained in the patent obtained on the 15th of last month, by the same gentleman. There is to be a door or shutter, which may be placed in the top of the boiler, which is to open upon hinges, instead of working in slides. By the intervention of several levers, this door is connected with the safety valve, and when the valve rises, this door, or shutter, is liberated, and is to open and allow the steam to discharge readily. A damper is at the same time to close the draft of the furnace, and streams of water are to pour upon the fire. Besides this, there is to be a fusible metal piece attached to the lower side of the boiler, and when this melts, a weight causes a rod to ascend, which passes through a stuffing box in the top of the boiler, when effects are to ensue similar to those produced by the rising of the safety valve. The array of catches, levers, and other appendages is equal, if not superior, to that of the former patent. If the safety of boilers cannot be established without the addition of numerous parts, every one of which is liable to derangement, we must make up our minds to run the risk of explosions. The effects of temerity, ignorance, and avarice, will not be prevented by such means. The present patentee has evidently been at much pains to attain the end desired, but we are convinced that his plans, if essayed, would prove to be entire failures.

There are no claims made in either of his patents.

---

15. For *Making Coke from Anthracite Coal,* for smelting ores, and for the preparation of steel; Moses Isaacs, Philadelphia, Pennsylvania, April 7.

The patentee informs us, that to convert anthracite into coke, he piles it up in the form of an arch, or cone, leaving space for the combustibles, and to heat it sufficiently; for this he uses wood, rosin, pitch, tar, or any similar substance; he places one or other of these under the anthracite, and kindles it, "to expel the vapour, foul air, dampness, &c. it renders porous, I throw on a quantity of water and flour, or water and lime mixed, or a quantity of glue, clay, or any other earthy or other substance which will dissolve in water, and stiffen or harden by being exposed to heat or air, for the purpose of cementing it together, which cools, and leaves it united, or coked, free from receiving foul air, dampness," &c.

We know something about anthracite, coke, and other kinds of fuel, but not enough to appreciate the value of the present discovery; to those whose understandings are less obtruse, we therefore commit the investigation.

The patentee, it appears, is not a citizen. He has not, however, taken the oath which the patent law prescribes to aliens.

---

16. For a *Metronome, called* "*The Accenting Metronome,*" to be used in teaching music; Uri Emmons, city of New York, April 7.

Those skilled in music, know that the ingenious Mr. Maelzel invented an instrument for beating time in music, which he called a *Metronome.* The beats were made by a pendulum, and the time changed by moving a sliding weight upon its rod. Mr. Emmons, instead of a pendulum, uses a fly, the wings of which are adjustable, as they can be made to approach to, or recede from each other, and thus alter the time of their gyration.

The instrument is to be wound up like a time piece, it having a barrel, and weight, connected with the movement necessary to act upon the fly. The time is counted by hammers striking upon a bell, which bell may be muffled by a piece of leather interposed between it and the hammers.

The claims are to "the simple form and construction of the above described machinery; especially that of dividing the time on the degrees of the wheel, and of arranging and lifting so as to produce the changes, and both common and treble time, with all the accents according to the different moods, together with the construction and application of the fly and index, by which the different motions are marked and regulated."

---

17. For a *Vessel for boiling Liquids of all kinds;* Richard M. Beach, Franklin, Delaware county, New York, April 7.

This vessel is a wooden trough with a bottom of sheet metal; it is to be set in brick work, so that the fire applied may come in contact with the bottom only.

Wooden boilers, with metal bottoms, have frequently been made, and are applied to various purposes.

---

18. For *manufacturing Spades and Shovels* by means of machinery; Charles Richmond and Samuel Caswell, Jr., Taunton, Bristol county, Massachusetts, April 7.

(See specification.)

---

19. For an "*Inclined Plane Friction Roller Press;*" Luther Carman, Oxford, Oxford county, Maine, April 7.

(See specification.)

---

20. For an improvement in the *art of Churning;* Elias V. Coe, Warwick, Orange county, New York, April 7.

"The following is a full and exact description of the art or manner of churning as invented or applied by me; which consists in the

application or forcing air into milk or cream, by means of an air or forcing pump, bellows, or other like machinery or instruments, propelled by hand, water, weight, steam, wind, animal, or any other power. ELIAS V. COE."

The foregoing brief, but emphatic, lines, constitute the whole of the specification. There, however, is a drawing accompanying it, with copious references, in which a jack is represented, which is to be driven by a weight of 300 pounds; this weight, through the intervention of the requisite wheel work, a part of which is "a wheel of three feet diameter, with 120 teeth," works two pair of small bellows which blow their wind through a leather tube into the barrel of cream. The whole appears to us rather airy, notwithstanding the great weight employed.

---

21. For a *Mould for making Scythe Sneaths;* John Knight, Woodbury, Gloucester county, New Jersey, April 8.

A mould is to be made for the purpose of bending the timber into the desired curvature, and as the sneath is usually bent in two ways, the mould must be formed accordingly. This is to be effected by marking the intended curvature in one direction upon a piece of timber of sufficient thickness, which may then be sawed through in the line of the curve. Upon the edge of one of these pieces a furrow, or groove, is to be made, having the curvature in the other direction; the furrow must be of such size as to allow the sneath to pass into it. When these two pieces are put together, they form the mould. The timber worked straight, and to the proper size, is to be softened by steam, driven endwise into this mould, and allowed to remain until it has obtained its proper set.

There is no claim made, but as the bending by steam is a common process, and not, therefore, the subject for a patent, the particular manner of making the moulds must be the thing intended to be patented; this we believe to be new, and it may consequently be legitimately claimed.

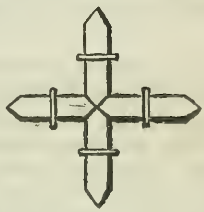
---

22. For a *Machine for making Horse Shoes;* David Anthony, Jr., Adams, Berkshire county, Massachusetts, April 8.

The horse shoe is to be formed by means of wheels, or rollers, of which there are to be four; they are to be made narrow upon their faces. These rollers have axes, the gudgeons of which run in a strong iron frame, in the centre of which their faces meet; they stand opposite to each other, in pairs, so that a section through their axes would form a +. They are geared together by bevel wheels, and all turn simultaneously. Their edges are bevelled, to bring them in contact, and their faces are so formed that a bar of iron passed between them will assume the shape required, and be countersunk, so that when bent round, the horse shoe will be in a nearly finished state. The wheels may be of such circumference as to form three shoes at one revolution. From these rollers the iron passes on to an apparatus

for bending it round in the required curve. The claim is to "the machine for making horse shoes as above described."

We have no doubt that a machine of the foregoing kind, if made with great precision, will give to the iron the shape desired, but as regards the validity of the claim, the same circumstance which interferes with many *new inventions*, stands in the way of this; it unfortunately is old. A machine of this description was first brought into use in England, and was eventually imported into France. Of the period of its invention we are not informed, but in the *Recueil Industriel*, for December, 1828, published in Paris, a description and plate of this instrument may be found. It is there denominated "a machine which is to give to iron all the different forms required in the arts, by means of a continuous rotary motion." The French account remarks that by an engine of eight horse power, operating upon a machine of the size designated, 3,000 nails of an inch in length, might be manufactured in a minute; and that by its aid iron may be converted into any desired form in a very rapid and exact manner.



A comparison of the patent before us, and of the accompanying drawing, with the description and engraving in the above journal, will remove all doubt with regard to the perfect identity of the two machines.

The opposite sketch will afford some idea of the manner in which the wheels, or rollers, run together. Were their angular points taken off, a square bar might be formed by passing the metal between them; and other desired shapes, it is evident, might be produced, by indentations of the proper form.

---

23. For *applying steam for blowing Fire;* Joel Eastman, Bath, Grafton county, Maine, April 8.

This patent is for applying an aelopile to the blowing of a forge fire. A strong cylindrical boiler is to be made, capable of containing two quarts of water. This is placed so that it may receive the heat of the fire, and, when necessary, some ignited coals are to be put under it; from the top of this boiler, a tube descends and terminates in the mouth of another tube which forms the tuyere. The opening in the steam tube is to be from one thirteenth to one sixteenth of an inch in diameter, whilst the tuyere tube is to be two inches in diameter at the outer end, and about one where it enters the fire. The claim is to "the application of steam to the blowing of fire as above described."

There is nothing new in the principle employed, or in its application. In the older, as well as the more modern books of philosophy, the principle is explained, and its application shown. It is not, in fact, the steam which feeds the fire, but, as this rushes forward it carries with it a considerable volume of atmospheric air, which produces the combustion. If an ignited coal be placed close to the steam tube, it will be extinguished; if at a distance, its combustion will be promoted.

In practice the plan will not be found to answer any good purpose, as the blast cannot be sustained and regulated, as with the common bellows. The contrivance is to be considered as a philosophical toy, rather than a thing of practical utility.

---

24. For a *Thrashing Machine;* Wm. B. Marks, Petersburg, Dinwiddie county, Virginia, April 8.

"What I claim as my invention is the reversed twisted bars on the cylinder, and concave bed, and their position as described in each, and also the twisted rods, or bars, and their oblique position as placed and described on the under feeding roller." So ends the specification.

If we could find any novelty in this arrangement, it would be some relief to point it out, as we are really tired with the almost perpetual repetition of the same opinion, that "there is nothing new." It might save trouble to our printer were he to get these words stereotyped.

---

25. For an improvement in *Mills;* being a mode of using the tread wheel, by combining its power with that of the tub wheel; Elias Davis, Bangor, Penobscot county, Maine, April 9.

The patentee claims as his invention or discovery, the *new principle* contained in his description of his mill. This new principle is to enable "a given power, (horse power,) applied to the tread wheel, to produce double the momentum that it has ever before been found capable of producing."

What the new principle is we have not been able to discover, as we see nothing more than a tub wheel on a vertical shaft, which is to aid and be aided by a horse wheel, the power of the two being conveyed to mill stones through the intermedium of a number of cog wheels, regulated by the momentum of fly wheels. There are altogether 9 or 10 wheels, which, we suppose, are, by their mode of combination, to produce the double effect claimed.

---

26. For a *Cylinder Corn Shelling Machine;* Jabez Parker and Hiram M. Smith, Richmond, Virginia, April 9.

This shelling machine has a cylinder with ribs of iron set spirally operating round it, like the teeth in the original corn sheller. The alterations, or improvements, upon which the patentees rely, is the increasing the velocity of the cylinder three fold, by gearing, which, whilst it reverses the motion of the cylinder, enables the operator to turn the crank with his right hand, and feed the hopper with his left. The manner of fixing the springs to adapt it to ears of different sizes. The bending of the iron ribs in such a way as to throw the cobs from the machine, and the "making the frame in an easy, simple, triangular form, thereby making it a firm, substantial brace to itself." We are assured that "by those improvements the machine is made for about the same expense as the former kind; is more

substantial and durable, and less liable to get out of order, is easier managed, will do the work better, and about three times as fast, with only half the labour." A gain of sixfold is a great gain, but notwithstanding this assurance we apprehend that it will be hard work even to feed with three times the ordinary speed.

---

27. For *Propelling Boats, Mills, Cars on Rail-roads, &c.*, by the means of a lever purchase, operated upon by cranks; Aaron Parkhurst and Silas Bacon, Scriba, Oswego county, New York, April 11.

We have here a train of wheels, cranks, levers, ropes, and pitmen; to be set in motion by the power of two men by the means of handles or levers, which are fastened to the wheels, one to each. Or there may be steam applied to a third wheel, by adding two cranks, &c. "or with water power on a wheel with the cranks." To this apparatus, which is at war with the horn book of mechanics, there is no claim; we do not apprehend, however, that the omission will be productive of any inconvenience to the patentees.

---

28. For a new and useful *mode of rendering a variety of articles water proof*, by means of fluid caoutchouc; George H. Richards, city of Washington, D. C., April 11.

(See specification.)

---

29. For a *Machine for mixing Clay or Mortar;* Aaron Parkhurst, Scriba, Oswego county, New York, April 11.

A circular trough, of the kind frequently used for mixing clay, is to stand upon a platform elevated for the purpose. Horses walking upon this platform turn a horizontal shaft, which carries a *mixing wheel.* The mixing wheel stands immediately above the circular trough, and from the lower side of its spokes iron spikes project downwards into the trough, these are to work the clay, or mortar. When mixed, a slide is removed, which allows the material to fall through into a receiver below the platform.

The part claimed is not designated.

---

30. For a *Machine for Washing and Churning;* John White, South Union, Logan county, Kentucky, April 12.

The body of this machine is a tub in the form of a common pickling tub; that is made larger at one end than at the other; slats of wood run from end to end on the inside, and the tub has gudgeons on the centre of each head by which it may be hung horizontally. There is a door for the admission of the articles to be operated upon.

When clothes are to be washed, the machine is to receive 20 or 30 turns in one direction, and then an equal number in the other, and so on alternately. In consequence of the conical form of the tub, the revolution of the barrel, causes the clothes to twist up; the

reversed motion twists them in the contrary direction, and this alternate twisting is said to clean them thoroughly without injury. Its operation as a churn needs no explanation.

The claim is to "the so forming the tub, that in washing, the clothes shall be alternately twisted and untwisted, in the manner above described, with the slats contained therein; and also the application of a similar tub to the purpose of churning."

---

31. For a *Smut Machine,* for cleaning grain; Levi Hayward, Phelps, Ontario county, New York, April 12.

The grain to be cleaned is dropped from a hopper into a hollow cylinder of sheet iron, standing horizontally, a large portion of the inside of this cylinder is set with spikes. A fan, with four wings, is made to revolve in this cylinder with a speed of seven hundred times in a minute; this is to throw the grain and smut against the spikes, which operation cleans the grain, and pulverizes the smut. From the cylinder the grain passes off into the eye of the stone, and in its passage the smut is blown from it by means of a fan wheel.

---

32. For an improvement in the *Water Wheel;* Martin Coney, Portland, Chataqua county, New York, April 12.

This is the often proposed plan of a strap, or endless chain, passing round drums, with buckets attached, to be operated upon by the water; there are no details setting forth any improvements, the whole description being general and imperfect.

---

33. For a *Machine for Breaking Stone* for turnpiking and other purposes; Benjamin F. Lodge and Ezekiel T. Cox, Zanesville, Muskingum county, Ohio, April 12.

A cast iron bed piece is to be provided, upon which the stone to be broken is placed. This bed piece may be about a foot in diameter, is to be concave on its upper surface, and perforated with holes for the broken stone to pass through. A ram or hammer is to slide between cheeks, or to be hung like a tilt hammer, for the purpose of breaking. The face of this hammer is to be furnished with projecting pieces, adapted to the holes, and suited to the concavity of the bed. Any of the known motive powers may be used to work the hammer.

"What we claim principally as new and useful, is the form of the bed, or block, and hammer; that is, the concavity of the one, and the convexity of the other; for we are aware that there has been an attempt made to introduce cast iron plates, or blocks, with holes for the purpose of breaking stone as above; but having a level surface, and being worked by a common sledge, or hand hammer, they have been abandoned as useless. The stone having a bearing upon the plate or block, directly under where the blow was applied, it resisted the force of the blow, and the blow produced little or no effect, and the pieces of stone broken off were liable to fly in any direction;

whereas our machine, having a concavity in the block, or bed, the stone has no bearing in the centre; and the hammer, of corresponding convexity, strikes first in the centre; the consequence is, that the stone is broken into a number of pieces the first blow, and the hammer being as wide as the bed, or block, prevents the stone from flying."

A machine for breaking stone, patented by Messrs. Bell and Andrews, is noticed at page 294 of vol. 6. In that, hammers, hung like trip hammers, are to be used, and the stone broken by them upon iron bars.

Machines for breaking stone are used in England, and are in some cases operated upon by steam; we have not met with any description of their precise construction. We could urge several objections to each of the machines patented here, and believe that the patenting them has not resulted from an experience of their practical utility; perhaps, however, when put into operation, they may serve as the foundation of good instruments. It is not to be expected that any machine, excepting it be one of the most simple kind, will fulfil the anticipations of its projector, without undergoing various modifications suggested by actual trial.

---

34. For a *process by which the Mineral Water of Congress Spring, at Saratoga, may be imitated;* William Meade, M. D. Newburg, Orange county, New York, April 12.

The receipt given is as follows—

1st. Take of tartaric acid, perfectly free from sulphuric acid; dry it in a very moderate heat, and then grind one ounce of it into a fine powder.

2nd. Take super carbonate of soda one ounce and a half, after it has been dried sufficiently to deprive it of its water of crystallization, and pulverize it.

3d. Take muriate of soda half an ounce, after it has been dried in a moderate heat, to deprive it of the whole of its water of crystallization, without decomposing it, and as much depends on the purity of this salt, it will be necessary to attend to the following particulars; it must be entirely deprived of muriate of lime and magnesia, which are generally combined with all species of common salt. They should be got rid of by pouring on the salt a sufficient quantity of alcohol of as high specific gravity as 826; this will take up the deliquescent salts, and leave the muriate of soda untouched; it must then be passed through a filter, and the muriate of soda made perfectly dry, after which it should be finely powdered, and one-half ounce of it carefully weighed.

4th. Take a small quantity of crystallized green vitriol, or sulphate of iron, expose it until it has fallen into a dry white powder. This must be added to the above powders in the following manner.

To one ounce and a half of the carbonate of soda, add two grains of the sulphate of iron, triturate them together; then add by degrees

half an ounce of the prepared muriate of soda, then one ounce of the tartaric acid, and triturate the whole until they are intimately mixed.

This powder is to be put into a perfectly dry bottle, to be kept closely corked, and when wanted for use, a small teaspoonful of it put into a tumbler, which is to be immediately filled with cold water, stirred, and drank, whilst in a state of effervescence.

We presume that Dr. Meade may sustain his claim to the precise mode of imitating the Congress Spring water, described by him; but certainly he cannot prevent any other person from combining together the ingredients which have been detected in it by analysis. That skilful chemist, Mr. G. W. Carpenter, of Philadelphia, has, for two or three years past, supplied the public with *Saratoga Powders for making Congress Spring Water*. These powders are noticed in the 16th volume of Silliman's Journal, p. 396. We are not informed of Mr. Carpenter's mode of preparing them, but he has made analysis his guide, and it is averred that they contain "all the essential substances with which these celebrated springs are impregnated, and from which the waters of the Congress Spring at Saratoga are precisely and effectually imitated."

A more simple process than the use of alcohol, will remove the muriates of lime and magnesia from common salt. All that is necessary is to pass through it a heated solution of itself in water; the water will dissolve the deliquescent salts, and deposite its own muriate of soda.

There is no *water of crystallization* in muriate of soda, although a minute portion is entangled among its crystals. There is no danger of *decomposing it*, in the drying, as heat alone will not produce this effect. The precaution given is therefore unnecessary.

---

35. For a *Machine for Shelling Corn;* Joel Barnes and Nelson T. Loomis, Cornwall, Litchfield county, Connecticut, April 13.

A solid cylinder of wood is to have iron teeth driven into it, as in the original shelling machine. A hollow curve is to be adapted to this cylinder, between which two parts the corn is to be shelled. Particular directions are given respecting the manner of forming this curve, which particular mode, or modes, constitute the essence of this invention, the claim being to "the construction and operation of the curves."

---

36. For a *Thrashing Machine;* Newton C. Munroe, Windham, Green county, New York, April 14.

We are told that the improvements in the thrashing machine here patented, "consist in the arrangement and form of the teeth in the cylinder and concave; the method of making and regulating the concave to adapt the machine to thrashing different kinds of grain, and in the mode of gearing, and applying power to drive the machine."

The teeth of the cylinder are to be made of No. 2 wire, and to extend out one and an eighth inch. The teeth are to be in rows, the tooth of one row standing opposite to the space in the next row. One-

half the rows of teeth stand straight out, forming radii from the centre, the other half are to be curved forward. The teeth of the hollow segment are of the same kind with those of the cylinder, but are all to curve forward, towards the point at which the grain is delivered.

The machine is to be driven by a horse, attached to a sweep turning a vertical shaft, with the gearing necessary to give the cylinder the proper velocity.

---

37. For a *Wheel for Propelling Boats*, being an improvement upon Antrim and Bolton's water wheel; Phineas Palmiter, Jr., Jamestown, Chataque county, New York, April 14.

A general description is first given of Antrim and Bolton's wheel, which description will answer very well for several different propelling wheels that have been patented, and which are intended to have their buckets kept in a vertical position. Those familiar with the subject are aware that this is in general effected by two wheels running eccentrically, and so connected as to produce the intended effect. We have not sought out the date of Antrim and Bolton's patent, not deeming this a point of any importance. We have noticed numerous wheels having the same object in view, but have never expressed an opinion favourable to any one of them, although we have several times been called to admire the ingenuity displayed in their construction. The present patent is taken for a new modification of the same principle; it has the merit of greater simplicity than most of those which have preceded it, but still we think that it will not be found equal to the simple wheel commonly used. This opinion is justified by the trials that have been made with similar wheels, which, upon fair and long continued experiments, have not been found to give an increased velocity. They must, however, excel greatly in this particular, or they will never be brought into use, as they are much more costly and liable to derangement than the old paddle wheels.

---

38. For a *method of Generating Gas, and of supplying and continuing Gas Light* out of oil or other suitable substance, by means of the gas light itself, in lamps, or machines, either fixed or moveable; Solomon Andrews, M. D., Perth Amboy, Middlesex county, New Jersey, April 15.

(A description of this, and of an auxiliary patent since obtained by Dr. Andrews, will be given in the next number.)

---

39. For a *Machine for Jointing Staves for Barrels;* George Eby, Clarence, Erie county, New York, April 15.

There are two jointers, each furnished with two plane irons, fixed by wedges in the ordinary way, but standing in opposite directions, so that they may joint a stave passing either backward or forward. These jointers are connected together by straps of iron united by pins, which pass through holes at a distance from the jointing part of

the planes, equal to that of the semi-diameter of the barrel to be formed; the faces of the planes standing in the direction of radii from these pins as centres. By means of a treadle, the faces of the jointers are made to approach each other, and joint the two sides of a stave at the same time; giving the correct bevel to the edge, whatever may be the width of the stave.

The stave is attached by suitable fixtures to a jointing bar, which is made to pass backward and forward, carrying the stave between the jointers, and tilting it so as to bring it alternately in contact with the irons at each end, in order to give it the required taper.

The claim is to the manner of fixing and working the jointers; the jointing bar; working and tilting as described; and the general arrangement of the machinery for producing the intended effect.

---

40. For an improvement in the manner of *constructing Ships and vessels of every description*, either for the purposes of war or commerce; R. Deming, city of New York, April 15.

(See specification.)

---

41. For manufacturing *Wooden Ware without Staves;* John Patridge, Zanesville, Muskingum county, Ohio, April 16.

Tubs and buckets of various kinds have long since been made by turning the rims out of a block of wood, and afterwards fixing the bottoms in them. On examining the specification of the present patent we are not aware that it presents any important improvement; the patentee lays claim, however, to "the manner of fixing the block in the lathe; the application of a gauge gouge and croes at each end of the rim; the saving operation of labour, and saving of timber; the gauge gouge and croes, [tools for cutting the groove,] to receive the bottom."

---

42. For *Apparatus for communicating Power to Machinery;* Samuel Kilburn, Sterling, Worcester county, Massachusetts, April 16.

The power with which this machine is to operate is derived from the weight of an iron ball, or other heavy body, attached to a shaft by a swiveling joint. By means of a crank the shaft to which the ball is attached is made to revolve; the ball, in revolving, acts upon two treadles, depressing them alternately. The power which is thus to be *generated*, is to be communicated to machinery by cranks and shackle bars, or other connecting parts.

The claim is to the making of the ball, or other heavy body, operate upon treadles as above described, so as by its gravity to concur with them in their descent.

Some ingenuity is manifested in the arrangement of the parts, although it is unfortunately expended in the construction of a machine to *absorb* and *extinguish* power.

43. For an improvement in the *art of Teaching Arithmetic;* Oliver A. Shaw, city of Richmond, Henrico county, Virginia, April 16.

It is proposed to make blocks of wood, or other material of different sizes, in regular progression, or bearing a certain ratio to each other, and by the arrangement, or alternation of place in these, to give sensible solutions not only of the cardinal rules, but also in decimal and vulgar fractions. The claim is to "the mode of teaching arithmetic as above described."

We have not only prepared blocks of wood upon the principles described, but have divided them into squares upon their surfaces, in order to illustrate both their relative proportions, and also the involution and evolution of numbers; but when we did this, we had not the most remote idea that we were establishing any claim to invention, or discovery, and have no doubt that at the period to which we allude, some thirty years since, the plan was then older than "auld lang syne."

---

44. For an improvement in the *Marine Railway*, called by the patentees "an improvement in the art of moving vessels or other heavy bodies on rollers;" Richard P. Joralmon, and Isaac Lockman, Northfield, Richmond county, New York, April 16.

The improvement here claimed consists in the use of rollers of a certain description, to serve as guides, as well as to diminish the friction in raising vessels up an inclined plane. The following extracts from the specification will afford a good idea of the plan.

"There are two streaks of timber, commonly called ground ways, about one hundred and fifty feet long, ten feet apart, lying parallel with each other, extending from the shore into the water, on an inclined plane, firmly fastened down, which have a surface of thirteen inches wide, on which are fastened two streaks of bar iron, running the whole length of the ways; these bars are placed four inches apart; there are rollers of cast iron, thirteen inches long, four inches in diameter, with a gudgeon on each end of two inches diameter; the rollers in the middle, for three and a half inches in length, are five inches in diameter, forming nearly a square shoulder at each end of the thick part of the rollers. These rollers are put in frames made of plank two and a half inches thick and nine inches wide, the plank being fastened together with pieces of wood, and cross braced to prevent them from racking; the rollers are placed in these frames at the distance of three feet apart; the gudgeons being in boxes of cast iron which are let into the plank. The rollers thus arranged, are laid upon the ground ways, and the swell or shoulder of the thick, or middle, part of the rollers, playing between the bars of iron on the ground ways."

The claim is not confined to the materials or dimensions given, and it is observed that the plan is equally applicable to inclined planes for canals, and also to the removing of heavy bodies in other situations.

45. For a *Pump for Raising Water or Air;* Jedediah Beckwith, Saratoga, Saratoga county, New York, April 16.

"The machine is a flat, water or air tight, circular box of iron or other metal, or sufficient material, of any required dimension or capacity, made stationary, and a valved wheel of like metal or material, revolving within the box by any power applied to a shaft or axle running through the outside plates, and upon which the wheel is suspended, with two holes through the rim of the box, one to admit the water or air into the machine, and the other to discharge it."

The remainder of the description consists of references to the drawing, which represents a well known rotary pump, made like many of the rotary steam engines which have been devised. The inside cylinder carries four hinged valves, which fill the annulus in which the water, or air, is to be contained, and close as they pass a metallic projection between the receiving and the discharging pipes. He must be a very good workman who makes such a pump *air tight;* and after he has done so, although his pump will certainly be distinguished by the skill it displays, there will be no novelty in its construction.

There is no claim made.

---

46. For a *Rotary Steam Engine;* Abel Greenleaf, Paris, Oneida county, New York, April 16.

The greater number of rotary steam engines which have been devised, differ from each other principally in the construction of, and in the manner of opening and closing the valves, and such is the case in the present instance. The description refers throughout to the drawing which accompanies it. The claim is in the following terms.

"What I claim as my invention, is the conical form given to that part of the shaft upon which the cylinder revolves, for the purpose of adjusting them to each other without packing; the attaching the piston to the arm, or lever, in such way as to give it play enough to adapt itself to the chamber of the cylinder. The manner of forming the piston in parts, so as to adjust it to the cylinder; and the particular manner in which the valves are made to slide through the head of the cylinder into the valve chambers."

---

47. For *using Zinc or Spelter for making various articles of Hollow Ware;* Samuel Davis, city of New York, April 18.

The specification is as follows.

"Be it known that I, Samuel Davis, of the city of New York, have discovered that zinc or spelter is well adapted to making various kinds of hollow ware; such as pots, kettles, pans, basins, dishes, pitchers, dippers, ladles, mugs, boxes, mortars, churns, firkins, inkstands, urns, knobs, ornaments for cornices and for stoves, looking glass and picture frames, sad or flat iron stands, andirons, sea boards for vessels.
SAMUEL DAVIS."

The specification of a patent obtained by the same gentleman, for *extracting cream from milk*, is inserted at page 368, vol. 6. In this

it will be found that vessels of zinc were proposed for containing milk or cream. The claim there made is in the following words: "What I claim is the manner of using the mineral called zinc, or spelter, in the reservoir, or vessels, containing the milk; and *preparing vessels or pans* from the zinc, or spelter." It will be seen, therefore, that the two patents are, in part, for precisely the same thing, and of this the law will not admit; otherwise, instead of having his patent for fourteen years, a man might contrive to render it perpetual.

It appears to us rather strange to say that it has been newly *discovered*, that a well known metal, which has been long since rendered malleable, which has been made into pipes, spouts, and other articles, which has been used for sheathing vessels, and covering houses, and has been cast into various forms, is "adapted to the making of various kinds of hollow ware," &c. If the inquiry be made why this has not been generally practised, we reply that it is entirely unfit for containing articles of food, as it is more readily attacked by acids than any other metal, and as its salts are more or less poisonous.

The total want of novelty in its application to culinary purposes might be easily shown; indeed it is sufficient for this purpose to turn to the article Zinc in Rees's Cyclopedia, where it is observed, that "it has been recommended instead of tin and lead for domestic purposes; but the ease with which it is oxydized, makes it very unfit for all kinds of culinary apparatus."

---

48. For a *Life Escape, and Fire Ladder;* James Johnson, city of Baltimore, April 18.

A car is made to run upon wheels; this car has a considerable elevation, and is so constructed as to form two or more platforms, retiring like steps, one probably ten feet above the other. The ladder, in sections, is to reach from one angle of these platforms to the next above it, where it is to be secured. Firemen with hose may stand upon the platform, and play directly into a window.

The apparatus is very indifferently described, and, as presented, appears liable to many objections. A carriage of this description requires too much space to admit of many of them being kept in large cities. Its elevation is such as to render it very liable to be upset in the hurry of repairing to fires, and when placed against a building which is on fire at the lower part, the machine will be in contact with it, whilst a common ladder would stand clear. There have been many contrivances made for a similar purpose, but they have not proved to be practically useful, being liable to the objections stated, or to others equally formidable.

---

49. For an improvement in *Couches, Sofas, Settees and Chairs,* called the "Windlass couch, sofa," &c.; Charles Adams, Boston, Suffolk county, Massachusetts, April 18.

The claim is to "applying the windlass principle in binding and

holding together the parts, and tightening the sacking or other material upon which the cushion lies."

The plan resembles that adopted in bedsteads, and for which a patent was obtained by the same gentleman. The rails are made round, and have round tenons, with a ratchet wheel and click at one or both ends of them. By means of these, sacking bottoms, cords, or similar appendages may be tightened.

The advantages stated to accrue, are the facility with which the before mentioned articles may be kept tight; the rendering the seats always firm and elastic, with less expense of material than when stuffed in the common way. The facility of taking apart and stowing for transportation; and greater economy in construction.

---

50. For an improvement in *Door Locks;* Andrew Wolfe, Pittsburg, Allegheny county, Pennsylvania, April 18.

Spiral springs are substituted for the usual flat spring over the tumbler of a door lock.

"All that I claim as my invention, is substituting spiral springs for the common flat spring. Said springs resting perpendicularly on the tumbler, with the cylindrical piece of metal in the centre of each spring secured to the tumbler, and working loosely in the groove on the under side of the square mortise; thereby rendering the lock more easy in its movements and more durable; the springs not being liable to break or lose their elasticity so soon as the common flat springs."

---

51. For a machine for *Cleaning Fur;* William Woodworth, city of New York, April 19.

(See specification.)

---

52. For an improvement in the mode of *Casting Metallic Tubes*, or pipes, of lead, or other soft metals; Burroughs Titus, Ulyssus, Tompkins county, New York, April 19.

(See specification.)

---

53. For an improvement in the *Navigation of Canals by Boats;* Samuel D. Ingham, New Hope, Bucks county, Pennsylvania, now residing in the city of Washington, April 19.

"This invention consists in the construction of a boat with a paddle wheel, or wheels located in its forward part, or bow, which wheels may be applied to any form of boats now in use, but most advantageously to that form usually denominated a twin boat."

It is proposed sometimes to put two wheels in the bow, in such positions as to propel the water along the interstice between the twin parts of the boats.

It is observed that these wheels may be propelled by steam or any other power; that when steam is used, one boiler and two engines,

one on each side of the boat, will be the most advantageous; the pistons being placed horizontally.

The object proposed to be attained, is to prevent the swell of water in front of the boat, and the depression of it in the rear, which occurs when boats are towed, or propelled by paddle wheels on the sides.

There is no claim made, but from the tenor of the instrument, it would appear that the placing of a wheel, or wheels, in the bow of the boat, is the point relied upon. This in itself is not new, and we do not therefore perceive any thing by which the patent is to be sustained.

---

54. For a *Thrashing Machine;* William J. Wood, Gennessee county, New York, April 19.

Instead of a cylinder with teeth, there is to be a wheel like a wagon wheel, one side, or face, of which is to be covered with teeth, or beaters, to a considerable distance from its periphery, towards the centre. This wheel is to run against a corresponding piece furnished with teeth. The construction and arrangement are not clearly described, or distinctly represented in the drawing, nor is there any claim made.

[TO BE CONTINUED.]

Specifications of American Patents.

Specification of a patent for an improvement in the method of Washing Rags for the manufacture of Paper. Granted to John Ames, *Springfield, Hampden county, Massachusetts, April* 6, 1831.

The improvement consists in dispensing with the washers, or screens now in use, and substituting in their stead a wire cloth cylinder, for carrying off the dirt and filth which may be beaten from the rags, or held in solution in the water, without the waste and delay of the old mode. The cylinder used by me is about twenty-two inches in length, and twenty-two inches in diameter, hollow, closed at one end, open at the other, surrounded by two coats, or coverings of wire cloth, and revolves upon an axis. I construct the cylinder as follows: the frame consists of metallic rods of suitable length, and sufficient in number to give strength and form to the cylinder, running parallel with the axis, and supported by arms of the same metal. Over these rods is first stretched a coarse wire cloth, and then over that is stretched another wire cloth of finer texture; any reticulated material, however, will do for the inner covering, as its principal object and use is to support the outer one without opposing any considerable obstacle to the free passage of the water into the cylinder. The cylinder is left open at one end, but is entirely closed by a metal disk at the other. Thus constructed, it is fixed in the washing vat, or engine, resting on arbours, with the open end adjusted to the side of the engine or vat, so closely as to prevent a waste of the

stock, and placed at a convenient height to allow a free passage of the rags around in the engine.

Within the circle described by the periphery of the open end of the cylinder upon the side of the engine, an orifice is made to let off the water which percolates into the cylinder. A band or gearing connected with other parts of the machinery communicates a rotary motion upon its axis to the cylinder, corresponding with the current, or roll of the stuff in the engine.

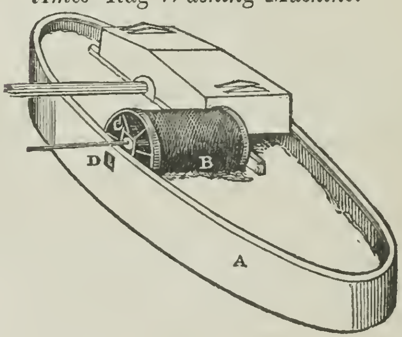
The benefit and utility of this improvement consist, 1st, in the saving of time in the preparing the rags for manufacture; 2nd, in dispensing with the washers now in use; 3d, in preventing a waste of stock, which in the ordinary mode of cleaning is very considerable. By my improved mode the dirty water is made to pass off more rapidly, and of course the clean water can be admitted more freely than when washers are used, through the apertures of which the pulp is driven by the force of the roll, or motion of the beaters, and so wasted, or clogs the washers by filling up the apertures, and prevents the passing off of the dirty water. By the rotary motion of the cylinder, by my mode, coinciding with the roll of the stuff, the water is freely received into the cylinder, and passes off.

The improvement which I claim especially as mine, is the process, or method, of washing, or cleaning, rags, by adapting the wire cloth cylinder to the common washing engine divested of its washers, to effect the objects before mentioned.

The wire cloth cylinder I do not claim as my invention for which I now seek a patent; it having been before patented by me.

John Ames.

Ames' Rag Washing Machine.



A, the vat.

B, the wire gauze covering to the cylinder.

C, the open end of the cylinder running close to the vat.

D, the opening through which water escapes.

Specification of a patent for an improved mode of manufacturing Spades and Shovels, by means of Machinery.—Granted to Charles Richmond *and* Samuel Caswell, Jr., *Taunton, Bristol county, Massachusetts, April 7,* 1831.

To all whom it may concern, be it known that we, Charles Richmond and Saml. Caswell, Jr. have invented an improved mode of

manufacturing spades and shovels by machinery; whereby much labour is saved, and the articles manufactured are made with greater truth and uniformity than by the modes hitherto pursued, and that the following is a full and exact description of our said invention.

The principal machinery which we employ is such as is well known to machinists; and to this, therefore, we make no claim, as we have merely so modified it, in size and form, as to adapt it to the purpose to which we apply it. That our mode of procedure may be perfectly understood, we have deposited in the Patent Office of the United States, drawings of the machinery, as modified and applied by us, and also a model of the same, corresponding with the drawings.

This machinery consists, first, of a cutting press, by which the plate prepared for making a spade, or a shovel, is cut out at one operation; and by another operation is punched, to receive the rivets necessary to attach the back strap and coffer, to the plates.

The second part of the machinery is a stamping apparatus, usually called a drop. This has a bed piece, or anvil, which is fixed below the sliding drop, and forms one part of the die by which the spade, or shovel, is to be shaped; the sliding part of the drop is made to correspond to this, and forms the upper part of the die.

To make a spade, or shovel, we take a bar of Swedish, or other, iron, and upon the side of this we usually weld a piece of steel. The bar is then rolled out to the size necessary for forming the spade, or shovel. It is then placed under the cutting press, and is cut out at one operation.

The same press receives dies to cut the strap, and also to punch the requisite holes, each of which is also effected at one operation.

The plates, so cut, are then placed in the drop, and by a single blow receive the form required.

The improvement which we have made in the manufacture of spades and shovels, and for which we claim a patent, is the use of cutters and dies, used in the cutting press and drop, by which the plate of which the spade, or shovel, is to be made, is first cut out, and afterwards stamped into the proper shape, each by a single operation.

CHARLES RICHMOND.
SAMUEL CASWELL, JR.

Specification of a patent for an improvement in the Standing Press, which the patentee denominates the Inclined Plane Friction Roller Press. Granted to LUTHER CARMAN, *Oxford, Oxford county, Maine, April 7th,* 1831.

To all whom it may concern, be it known, that I, Luther Carman, of Oxford, in the county of Oxford, and state of Maine, have invented an improved press, applicable to a great variety of purposes, which press I denominate the *Inclined Plane Friction Roller Press;* and that the following is a full and exact description of the same.

I construct a frame of wood, or iron, in the ordinary form of frames for presses. That is, having cheeks, or uprights, with a bed piece, or sill, and a cap piece strongly framed into, or otherwise attached to, them. Between the cap piece and bed, a third piece is framed, or attached to the cheeks in the same manner. This third piece may be much smaller than the other two, as it merely operates as a guide and support to the other parts, but does not sustain any of the force of reaction from pressure.

The pressing power is derived from the action of friction rollers against an inclined curved surface, which is effected in the following manner. A strong iron shaft has its gudgeons fitted into holes in the cap piece, and the intermediate piece above named. The lower gudgeon passes through this latter piece, as it is by its descent that the pressure is exerted. The upper gudgeon has sufficient play in the cap piece to allow it to ascend and descend the distance required. A wheel, having a wide rim, is attached to this shaft. The upper edge of the rim of this wheel has two scallops, or indentations, made in it, which correspond exactly with each other, and are made of such depth and inclination as may suit the purpose to which the press is to be applied. Two strong friction rollers are attached to the under side of the cap piece of the press; their faces being in contact with the upper rim of the wheel. The wheel is borne up by means of springs, or weighted levers, or by a rope passing over a pulley, carrying a weight sufficient to counteract that of the wheel and axle.

When this wheel is turned by means of a lever, the friction rollers acting upon the indentation on its rim, will cause it to descend either rapidly or slowly, and with a varying degree of speed, or force, depending upon the degree and form of the inclination in the indented parts of the rim. The two rollers, acting at points diametrically opposite, prevent all strain upon the wheel. Where great power is required, cogs are placed around this main wheel, and a pinion with any number of teeth, is employed to turn it; a lever being applied to the shaft, or axle of such pinion.

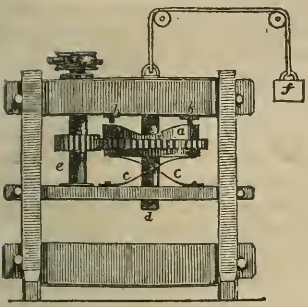
This press may be inverted, in which case the wheel will, by its own weight, rest upon the rollers. It may also, if desired, be made to press in a lateral direction. It is applicable to the purposes of cutting; of raising by means of dies; of printing; pressing bricks, or cheese; and, in fine, to any purpose where great power, and a moderate range, are required.

Cutters, dies, a platten, or follower, &c. may be attached to the end of the shaft, which passes through the intermediate piece above described.

What I claim as my invention, and for which I ask a patent, is the application of friction rollers on the indented edge of a wheel, in the manner, and for the purposes above described.

Luther Carman.

Carman's Press.



a. The wheel on the rim of which the pressure is exerted.

b, b. Friction rollers bearing against the rim.

c, c. Springs by which the weight of *a* may be sustained.

d. The shaft conveying the pressure by its descent.

e. Pinion, turned by a lever and acting on the teeth of the wheel *a.*

f. A weight which may be substituted for the springs *c, c.*

Specification of a patent for a mode of rendering a variety of articles water proof, by means of Fluid Caoutchouc, and of otherwise using that substance so as to produce new and valuable results. Granted to GEORGE H. RICHARDS, *Washington, District of Columbia, April* 11, 1831.

IT is well known that the substance commonly called gum elastic, or India rubber, but more correctly Caoutchouc, is produced by the desiccation of the sap or juice of several plants, and particularly of the Haevia Caoutchouc, and Jatropha Elastica, growing in the southern part of this continent, and from the Urceola Elastica of Asia. This substance, in the fluid form, has never been applied to the purposes of manufacturing or preparing of many things to which it is peculiarly applicable, although bottles, shoes, boots, balls, and sheets, have been formed thereof in the places where the above named and similar plants grow. It is true, that for the purposes of philosophical experiment, small portions of the juice have been taken to Europe, and brought to this country, but it has never been advantageously employed for purposes of utility, until the same was done by me.

Solutions of the indurated substance, as usually imported, have been made in ether, naphtha, oil of sassafras, spirits of turpentine, the spirits of coal tar, and in other liquids, and a varnish has been thus made which has been occasionally applied to useful purposes. I therefore except from my application and use of caoutchouc, the aforesaid or other solutions, made from the solid material.

In my application of caoutchouc, I obtain it in its original fluid state, and I use it either *substantively*, that is to say, by itself alone, or I employ it in connexion with other substances, as a cement, or as a varnish, for covering, impregnation, saturation, or stiffening. By its use I render the objects to which it is applied either elastic, durable, water proof, or air tight, according to their natures, and the purposes to which they are applied.

When used as a cement I sometimes employ it alone, and some-

times I mix it with glue, pitch, tar, or other adhesive articles, and employ it either in a cold or warm state, the latter, or warm state, being in most instances the best.

Without attempting to enumerate, or specify the various objects, or substances, to which I mean to apply the fluid caoutchouc, I will mention a few of them.

I intend to apply it to cloth of every kind, to silk, cotton, ropes, cordage, strings, and all other articles manufactured from fibrous materials. As a varnish to leather, wood, or other porous substances, so as to cover or saturate the same. As a varnish to protect metals from oxidation.

I sometimes mix with the fluid caoutchouc, the metals, metallic oxides, earths, or other solid substances, either simply, or in combination, but generally in a state of minute division, and I thus produce a variety of compound substances, possessing any desired degree of hardness, or combining ornament with utility, according to the nature and objects of the mixture.

The action of atmospheric air, and of solar heat, is sufficient to convert the fluid into a solid substance; but it is best, in general, to facilitate the process, by exposing it to artificial heat. The caoutchouc, or its compounds, may be applied by dipping the article to be covered, or saturated, into it; or a brush may be used in the manner of varnishing. No particular directions are necessary upon this point, as every thing must depend upon the nature of the substance upon which the operation is performed.

I claim as original the useful application of the *native fluid caoutchouc*, as set forth in this specification, either alone or in combination, when employed for the purposes, or in the manner hereinbefore set forth.

GEORGE H. RICHARDS.

Abstract of the specification of a patent for an improvement in the manner of constructing Ships and Vessels of every description, either for the purposes of War or Commerce. Granted to JOSEPH R. DEMING, *City of New York, April 15th*, 1831.

THE improvement consists in uniting together what may be called sundry horizontal frames of suitable timber, placing them one upon another, in such a manner as to make the hull or external part of the ship or vessel, *one solid wall of timber*, with the exception of the bolts and nuts of metal necessary to secure the said frames firmly together. The grain of the timber is, of course, as near as may be in the direction of the line of a figure forming a horizontal section of that portion of the ship or vessel to which it belongs. The frames above mentioned, and which I have spoken of as being horizontal, are not, however, of necessity, of the same vertical thickness one with another; nor as regards any one frame is the vertical thickness thereof, of necessity, the same in its different parts. For as the ver-

tical depth in all, or nearly all, ships or vessels, is greater at the head and stern than it is amidships, it follows, of course, if a ship or vessel be wholly made of entire frames, piled upon, and firmly secured to one another, that the vertical thickness of these frames will be greater at their extremities than in the middle.

In some instances it is proposed to interpose pieces of timber between one or more pairs of frames, particularly at the stern; the grain to run as nearly as may be in the direction of the length of the ship, and also of the curvature of the part in which it is placed.

Two methods of securing the deck beams are given. One by permitting their ends to extend through the sides of the ship, the beams having, if desired, a shoulder on the inside; they are then to be made fast to the hull by screw bolts, dagger-knees, hanger-knees, &c. The other mode is the making the frame in that particular part of the hull sufficiently thick to extend inwards and allow the deck beams to rest on them, and then securing them as above.

This mode of building dispenses altogether with plank, either on the inside, or outside; and also with standing timbers, except it be a stern post, and one or more short pieces underneath the cut water, to serve as a protection from injury to the part called the gripe.

The mode of building is to shape and lay down the keel much in the usual way. At each end of the upper surface, a piece of timber of proper size and shape, forming the *dead wood*, is attached by screw bolts. Pieces extending from one dead wood to the other are made fast to the keel, by screw bolts; these are to be fitted to the dead wood, and to each other, by *butt joints*, *scarf joints*, or *hook scarf joints*. The bolts being so placed that when the vessel is caulked no part of them will be exposed to the action of the water. These pieces, when so fixed, may be considered as constituting the first frame.

A second frame, with dead wood pieces, is then to be laid on the former, and secured by screw bolts long enough to reach through both frames. Pieces of canvass, dipped in white lead paint, or other suitable preservative matter, are to be laid between the timbers as they are bolted together, but this is not to be done to any greater height. The frames are to be laid successively in this way, recesses being made for the heads of the bolts, and the joints all having the canvass, &c. interposed. Tree nails may also be driven as the work proceeds, boring holes diagonally for this purpose. When built to the proper height, the deck beams are to be secured in their places by one or other of the modes above indicated.

When the vessel is completed, the seams are to be caulked, although, from the manner of screw bolting together, it is nearly impossible that any leak can exist. The timbers are, of course, to be so arranged as to *break joints*.

The advantages proposed to be attained are, the using of less timber, and the obtaining of greater strength; to insure tightness even without caulking; to be able to work on the inside, even at sea, by a temporary removal of the cargo, should a leak occur; to make iron bolts less liable to decay, by protecting them from contact with the

water; greater security to persons and property; greater durability, and avoiding the recesses in which foul air is generated.

"*I claim as new*, the foregoing described method of constructing the hull of a ship, or vessel, by uniting timbers piled upon and secured to one another in such manner that the grain of each piece of wood, shall, as near as may be, be in the direction of the part of the said ship or vessel to which it belongs, dispensing with the use of planking, except it be for the decks."

"*I claim as new*, the application of canvass and white lead, or other similar substance, laid in the seams between the timbers, so piled upon and secured to one another by the screw-bolts and tree-nails heretofore and herein described."

"*I claim as new*, the use of screw bolts to fasten together the various series of frames of timber, above described, in manner such that they may be wholly protected from coming in contact with the water; and,—

"*I claim as new*, the plan herein referred to, of constructing the *trunks*, as they are usually termed, made use of when centre boards are employed in ships or vessels; the advantage which this plan offers consisting in the trunk being made of a series of separate pieces of timber, piled upon and secured to each other by screw bolts, &c. as above mentioned, but each piece being morticed through, to receive the centre board; thus making it practicable to render the trunk perfectly tight; a fact which now seldom or never happens."

JOSEPH R. DEMING.

Specification of a patent for a machine for Cleaning Fur. Granted to WILLIAM WOODWORTH *of the city of New York, April* 19, 1831.

THIS machine consists of a series of wheels, like water wheels, placed near each other in a horizontal frame covered in on the top, and bottom, and sides, the cover being as near the periphery of the wheels as may be consistent with their free motion, and lined with a cloth. A feeder is adjusted to one end, and at the same end of the series of wheels, a picker, which takes the fur as the feeder delivers it, and by the rotation of the wheels, with a certain rapidity, and alternately, in opposite directions, the fur is carried through the series, and as it passes on it is freed from the hair, which is attracted by the cloth lining, and adheres to it, so that the fur issues from the other end of the machine perfectly cleared from hair by a single operation, at which other end is placed a gauze bag or other receptacle in some convenient form to receive the fur as it issues. The wheels may be of the same or of different diameters, and of any convenient length; the beaters thereon constructed, like the buckets or paddles of water wheels, may be of any convenient number and dimensions. The wheels, supported on axes or gudgeons, working in boxes, set in the frame, may be of metal or other material. The

frame, made of wood, or other material, consists of two pieces which may be called cheeks; these are supported on a sufficient number of legs, or feet, according to the length of the cheeks, which must be long enough to hold the number of wheels to be used, be they more or less, or larger or smaller. These cheeks are framed together firmly by cross pieces and ties, in such a manner, and of such a length, that the wheels may freely revolve between them, the wheels to be placed at such distances as to revolve freely without touching each other, but as near as may be, consistently with this object. They must be covered in at the ends as well as above and below them—the cover should set close to the top and bottom of the wheels, coming to the sharp angles where the wheels are near each other, and these angles so formed as that the space between the edge of the angles and the wheels will be larger where the fur enters between the cover and the wheels respectively, than where it leaves them respectively. This is convenient, as it favours the passage of the fur from wheel to wheel. The cloth, it is believed, will best answer the purpose which has the coarsest and fullest nap. The attraction and adhesion of the hair to the cloth lining is ascribed to electricity therein produced by the motion of the wheels, and this power of attraction, it is contemplated by the inventor, may be increased in the cloth lining so as to make it electric to any requisite degree by common and known means. The picker, placed as aforesaid, consists of a cylinder with points set therein, so placed in respect to the delivering end of the feeder as to take the fur and tear it from between the delivering rollers of the feeder and distribute it to the wheels as aforesaid. The feeder is of common construction, and the wheels and picker are put in motion by a band running over wheels fixed to their respective axes; the motion of the feeder is adapted to the picker, and the motions of these are adjusted to each other and to the wheels, so that the machine shall have in all its parts a convenient velocity, according to the quantity of fur to be cleared and the supply conveyed to the machine by the feeders in a given time. The number of wheels and their dimensions are left at large, because these may be indefinitely varied, and yet the principle of the machine be the same, as hereinafter is shown. But the number of wheels, and their dimensions, actually used by this applicant in his first operation, were as follows—there were 7 wheels from 6 inches to 2 feet in diameter. The dimensions of the frame, and of the cover, and of the picker, and of the feeder, all obviously depend upon, and are adapted to the number and dimensions of the wheels. By a machine of this description the applicant has cleared fur of hair perfectly in one operation.

The principle of the invention consists in the combination of wheels with a cover lined with cloth, substantially, as above described, having a feeder and a picker of common construction, the dimensions of the same being variable at convenience as aforesaid.

And this applicant contemplates the application of this principle in combination with any common and known apparatus for electri-

fying the cloth lining, and purposes on further experiments to apply for patents for such and other improvements.

William Woodworth.

Woodworth's Machine for Cleaning Fur.

Fig. 1.

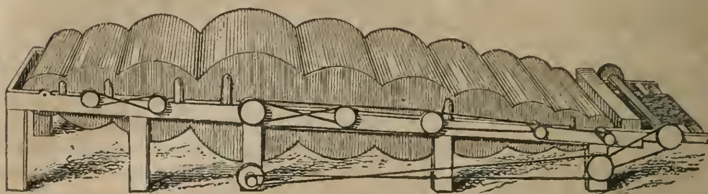


Fig. 2.

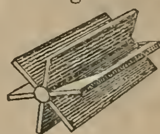


Fig. 1, a perspective view of the whole machine.

Fig. 2. one of the wheels, or beaters, which revolve in the cylindrical cases.

Abstract of the specification of a patent for an improvement in the mode of casting and making of Metallic Tubes, or Pipes, of lead and other soft metals, or composition of metals. Granted to Burroughs Titus, *Ulyssus, Tompkins county, New York, April* 19, 1801.

The object of this patent is to produce pipes of any desired length, without seam or joints. The plan is to conduct the fluid metal into a mould of a proper form, but of moderate length, and causing the metal to be cooled so as to adhere, and at the same time giving a regular motion to the tube, so as to draw or force it from the mould as fast as it becomes effectually cooled.

The apparatus by which this is to be effected is shown in the accompanying drawing.

A, A, is a hollow cylinder of metal, bored out, so that its inner diameter shall be equal to that of the pipes intended to be cast. Its length for a pipe of $1\frac{1}{4}$ inch, may be about 8 inches. It has a flanch, *a*, *a*, at its lower end. This tube gives the form to the outside of the pipe to be cast. B, is a plug or core, adapted to the inside of the pipe, and made of iron, or other suitable metal; it must be perfectly smooth, and slightly tapering, being smallest at top. It has a flanch, *b*, *b*, adapted to the flanch *a*, *a;* this flanch is perforated with a number of holes, to allow the fluid metal to pass up into the mould. C, C, is a basin to contain water, standing up to the dotted line, *f*, *f*.

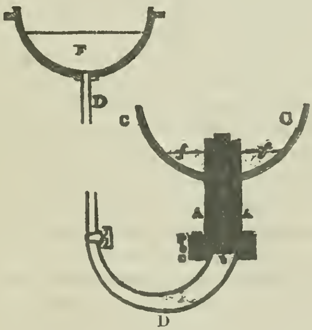
D, D, is a tube by which the melted metal is to be conveyed from the melting pot, F, into the mould. A, stop cock, regulates the flow of the metal. The tube, D, D, is furnished with a flanch, *c*, by which it is connected with the mould.

The melting pot may be placed so high up that the pressure of the melted metal will be sufficient to force the pipe from the mould, with a regular motion, as it is cooled by the water, this force being regulated by the quantity admitted by the stop cock. The pipe, D, D, must descend through a flue kept sufficiently heated to keep the lead in a fluid state, and heat must also be applied at its junction with the mould. Instead of elevating the melting pot, an arrangement may be made for making a mechanical pressure upon the surface of the lead, and thus to produce the same effect.

The pipe, as it is forced off, may be received upon a reel, or drum, placed above the mould.

We have omitted a large portion of the specification, but have given what is necessary to render the plan intelligible. A patent has been obtained in England for machinery for the same purpose, but not of the same construction. We believe that under proper modifications, which experience alone must suggest, the principle above described may be advantageously applied to the accomplishment of the object proposed.

Titus's Machine for Casting Pipes.



ENGLISH PATENTS.

Patent granted to MATTHEW UZIELLI. *The preparation of certain metallic substances, and the application thereof to the sheathing of Ships, &c. Communicated by a Foreigner. Dated January* 6, 1831.

THE invention consists in giving ductility and malleability, (for the purpose of making it into sheets,) to an alloy composed of copper and tin solely, or which is so far free from the admixture of zinc or lead, as to be harder and less liable to oxidation than pure copper or common sheet brass, and which alloy is brittle when first cast,

and before it is subjected to the process hereinafter described, but is thereby made into malleable and ductile sheets, which, from their being less liable to oxidation than pure copper, are therefore more applicable to the sheathing of ships, for covering roofs of buildings, making spouts and gutters, and other purposes where sheets are required, which will not be liable to much oxidation.

This alloy I would recommend to consist of copper and tin only; for although an admixture of zinc or lead in small proportions, which will not be sufficient to make an alloy laminable into thin sheets by any process hitherto used, say one or two per cent., will not very materially increase its liability to oxidation, while it renders it a little less brittle, and therefore more easily manufactured, still every little addition will increase its liability to oxidation, and therefore is better avoided: the proportions which I have found best adapted for the purposes before mentioned, are one hundred of copper, with five to seven of tin. A less quantity of tin than about five per cent. makes an alloy which is too liable to oxidation, and is little preferable to pure copper; and a greater quantity than about nine per cent. makes an alloy so hard and brittle, and requires so much care and labour to make into malleable sheets as to become too expensive an article for sale. This alloy is manufactured into malleable and ductile sheets in the following manner:—Having melted the copper in a reverberatory, or any other furnace adapted to the purpose, or in crucibles, the tin is added, as also the zinc or lead, if the alloy is to contain any, and then the metals are to be mixed and well incorporated together by stirring whilst in a state of perfect fusion. The melted mixture, or alloy, is then to be well heated, and a sufficient quantity is to be poured into moulds formed between two strong tables of smooth granite or other suitable substance, so as to obtain a flat plate of from three-eighths to three-fourths of an inch in thickness, according to the ultimate thickness of the sheets required. The thickness, length, and breadth of the plates, may be varied according to circumstances, by the thickness and position of metal rules, which are to be interposed between the tables of granite to keep them apart, and to leave the space which forms the mould for the melted metal. The plates thus cast may be cut into smaller pieces, according to the size of the sheets ultimately required, or the original size of the plates may be adapted thereto, taking care in either case to allow twenty to twenty-five per cent. for waste in the manufacture. It is better that each plate should contain a sufficient quantity of metal to form two or four sheets, so as to be doubled up and rolled in a subsequent stage of the process. These plates are placed in an annealing furnace, or in any other furnace adapted to the purpose, where they are very gradually heated for two or three hours until the plates are raised to a dull red heat, when the alloy contains from five to seven per cent. of tin; but if it contains more tin, the heat must be lower and applied more gradually, and if it contains less tin, the reverse. The plates are then allowed to cool very gradually, which will take about an hour, and when perfectly cold are passed three or four times through the rollers of a suitable rolling-mill,

which are set so as to effect but a very slight reduction of the thickness of the plates. The rollers should be so adjusted during the first cold rolling, after the first annealing, that when the alloy contains the proportions before recommended, of five to seven per cent. of tin, passing these three or four times between the rollers, should not lengthen plates of the thickness before mentioned more than about half an inch in two feet length; but if the alloy contains more tin they must not be lengthened so much, and if it contains less tin, the reverse: great care must be taken that in this and subsequent rollings the plates be rolled always in the same direction. The plates must then be again annealed, taking the same precautions in heating and cooling very slowly, and to the same degree as before, and again rolled in a cold state with the same precautions as to the pressure of the rollers, and in rolling the plates in the same direction as before. The annealing and rolling are repeated with the same precautions, and to the same extent, until the texture of the alloy is changed, as may be known by the fracture being found close and fine grained, instead of crystalline and with facets as when it was first cast. With the proportions before recommended, the close and fine grained texture generally takes place after twelve or fifteen successive operations of annealing and cold rolling. After the texture of the alloy becomes thus changed, it may be heated more rapidly and to a higher temperature, and when cold rolled, so as to lengthen plates, which, when first cast, were of two feet length, six or seven inches after each annealing. The plates, or sheets, as they may be now called, may then be bent up and rolled double, in the usual manner of rolling brass sheets, but continuing always the precaution of rolling in the same direction.

After sufficient rolling the sheets may, if necessary, be doubled again, according to the thickness and size of the sheets required, and when sufficiently rolled, the sheets are to be trimmed and cut to the required dimensions, as usual in rolling brass or copper. The precautions particularly to be observed are casting the alloy in thin plates, heating and cooling them very gradually, and rolling them cold, very gently at first, in the same direction.

Now, I declare, I do not claim as part of the invention the making of sheets of an alloy, which is commonly called brass, and which has heretofore by repeated annealings and cold rollings, in a method somewhat similar to my own, been made into malleable and ductile sheets, but which alloy commonly called brass, is composed of copper, with a large proportion of zinc, or of copper, with a large proportion of zinc and a certain proportion of tin or other metals, but is more liable to oxidation than fine copper, and therefore not so fit for the purposes before mentioned; but I do only claim giving malleability and ductility, for the purpose of making it into sheets, to an alloy which is less liable to oxidation than fine copper or brass, and which heretofore, from its brittle nature, has not been manufactured into sheets.

In witness whereof, &c.

Patent granted to Andrew Ure, *of Southampton Row, in the county of Middlesex, M. D., for an improvement or improvements in curing raw or coarse sugars. Dated October* 20, 1830.

The nature of this process consists in employing faintly acidulated alcohol as a solvent to remove the quicklime and glutinous extractive with which raw sugars are mingled.

The proportion of acid employed is one ounce of sulphuric, nitrous, or other powerful acid, to one gallon of alcohol, at forty degrees above proof.

The sugar cleared by this mixture, it is stated, will be sufficiently freed from impurities as to admit of its being packed in bags instead of hogsheads.

The claim is not for the use of the alcohol, but for the combination of the latter with the acid for the purpose mentioned.

Patent granted to John Dickenson, *of Nash Mills, in the parish of Abbot's Langley, in the county of Hertford, for an improved method of manufacturing Paper by means of machinery. Dated October* 6, 1830.

The object of the present patentee is to make paper in two layers or strata, before such layers leave the felts by which they are conducted to the drying machinery; for this purpose two cylinders of woven wire are immersed in two vats of pulp some distance apart. The pulp collected on the first cylinder is conducted by a felt and the necessary rollers to the second cylinder, from whence the two layers, thus coming in intimate contact, are carried forward by the same felt to the press-rollers, (of which there are two pair,) that form them into a single substance—this is then conveyed to the drying machinery in the ordinary manner.

This method is chiefly applicable to the manufacturing of thick papers, the adhesion being greater when the layers are thus joined, whilst in a wet state, than when united subsequently to their passing the drying apparatus.

Patent granted to Andrew Ure, *of Southampton Row, in the county of Middlesex, M. D., for an Air-stove apparatus, for the exhalation and condensation of Vapours. Dated October* 20, 1830.

This invention consists in drawing a stream of air by an exhauster through a chamber over the surface of any moist substance so heated as to exhale vapours, and then propelling the mingled air and vapour through a body of cold water, or other absorbing body, for the purpose of condensation.

The chamber is directed to be constructed of wood, copper, or

other suitable material, and of a rectangular form, (as being most convenient,) and much longer in proportion to its depth. At one end of the chamber, immediately below the roof, is a pipe, through which the vapour exhaled from the substance under operation is extracted; it is connected with an exhauster, which propels the vapour into a cistern where it is condensed. At the opposite end of the chamber to that where the exhausting pipe is fixed, is a sliding door, which may be opened to admit a stratum of air sufficiently thick, according to the intensity of the heating medium, in order to facilitate the exhalation. The substance to be evaporated may be heated by steam pipes or hot water, contained in a second chamber below the evaporator.

This apparatus, it is observed by the patentee, is particularly suited for evaporating raw sugars without injuring their quality.

Patent granted to MICHAEL DONOVAN, *of the City of Dublin, Gentleman, for an improved method of lighting places with Gas. Dated October* 6, 1830.

THE patentee commences his specification by observing, that there are many gases which burn with but a small emission of light, such as hydrogen gas, carbonic oxide gas, and that gas produced by the chemical action of water or steam on the surface of red-hot coke or charcoal. He proposes to produce a good light from these gases by combining them with the vapours of certain volatile substances, such as spirits of turpentine, vegetable resins, naphtha, and naphthaline.

In order that vapour should be produced from these substances, a reservoir is directed to be placed near the burner, so that the heat emitted from the burner itself may produce the necessary effect. The distance of this reservoir from the flame is to be regulated according to the degree of volatility of the substance employed; for, if naphtha be employed that has been several times distilled, it will produce vapour at the temperature of the atmosphere, the reservoir must be in that case removed some distance from the burner, or much smoke will be emitted with the flame, according to the excess of vapour; if, on the other hand, sufficient vapour be not mingled with the gas the light will be less bright.

The gas, (in the instance cited by the patentee,) is generated in a cylindrical iron retort, of about eight inches diameter in the interior, and about three and a half feet in length. This being filled with coke or charcoal, over which water or steam has been thrown, is to be heated to a red heat. The gas thus produced is conducted by a pipe to the lower end of what is termed the recipient, consisting of a small tube or cylinder below the burner. A tube of about half the diameter of this recipient arises concentrically with the latter from the gas supply pipe: this tube, which is perforated with numerous small holes, is denominated the disperser; near the top of this a division is made to prevent the gas from passing through the upper

part without mingling with the vapour, and several convolutions of fine woven wire are wrapped around the disperser to render it more effectual in causing a perfect intermixture. The combined vapours then pass into a burner similar to those usually employed for gas, and it is stated they will then afford a clear and bright light.

New Dye.

We live in an age of improvements. Last week our *Gazette* contained the first public intimation and account of a discovery which promises every man his dram with his bit of bread; since the loaf, in its baking, is found to give out a vapour which needs only to be collected to furnish an excellent spirit. Now, therefore, ovens may also be considered as stills, and the staff of life will be the more required to support those whose heads it may tend to turn by its odorous products. But our present purpose is with a new method of dying with Prussian blue, which is stated to be so efficient and cheap, as entirely to supersede the necessity for indigo. The prospectus issued by the inventors of this commercially important composition is now before us. It states that since the year 1752, the attention of the most able chemists of Europe has been directed to the discovery of some means by which a fast blue dye might be obtained without the use of indigo; but that hitherto their researches have been attended with no favourable results, inasmuch as the use of Prussian blue, (the only substitute that could be used,) has been found to render the wool too hard to work well, and at the same time to burn it. But the inventors, who, we believe, have secured their discovery by a patent, assure us that their experiments have succeeded, and that they are prepared to submit to the public, specimens of blues, which have been produced without indigo; the tints of which are equal, if not superior to any colour that has yet been produced by that dye, and its durability incomparably superior. Specimens, they add, will be produced of clothes that have been worn until there literally remained but the thread, and yet the colours are as firm as when first the cloth was cut, nor is there the slightest appearance of white upon any of the seams; a fastness of dye which has never been produced by indigo. We ought to mention that these specimens have been exhibited to us, and that they fully bear out the description given. Among the advantages which the proprietors promise from the adoption of this dye, are the following:—All the substances which compose it are indigenous to all countries, are abundant and cheap, not only in consequence of their great plenty, but also from many of them being absolute refuse, such as old woollen rags, meat unfit for use, blood, entrails, and, in fact, every description of animal matter, however corrupt may be its state:—as a new branch of industry, the manufacture would be a national benefit:—a much greater solidity, beauty, and brilliancy of colour, than hitherto attained, and a capability of being brought to any tint required:—in an apparatus of equal capacity, three times more wool can be dyed by this process

in a given time, and at an infinitely less cost than can be dyed by indigo:—wool dyed by the new process is in every respect better to work, is softer, cards better, and is more pleasant and easy to weave than when dyed with indigo:—it is not only applicable to blues, but is equally efficient as the foundation for blacks and greens; those colours being produced of the most beautiful tints;—for hats, the beauty and intensity of the black it produces, and the rapidity with which the operation of dying is performed, renders the discovery invaluable to that branch of trade. Such are the advantages proposed by the adoption of this process; and assuredly a discovery which would lower the price of articles of universal consumption and in constant use, and open a home employment of great extent, in the room of foreign and imported produce, is well worthy of the consideration of a commercial people. We can only speak of the thing from what we have seen, and the old and new clothes shown to us seemed completely to warrant the pretensions which accompanied them. We have no doubt but that both practical skill and large capital will soon put this novelty to the test; and were it ours, we should not be afraid to "stand the hazard of the die." [*Lit. Gaz.*

The Monthly American Journal of Geology and Natural Science.

Two numbers of the above Journal have issued from the Philadelphia press, under the editorial management of G. W. Featherstonhaugh, Esq. We hailed the work in advance as likely to promote the knowledge of a very interesting department of science, but we have to regret that the editor has already given proof of a total absence of those dispositions and habits without which a person is altogether unfit to become one of the sentinels of science. In his notice "*to readers and correspondents*," he has charged this Journal with having "become the vehicle of defamation in its most insidious form," and has designated one of the most usefully active members of the Franklin Institute, as "one of the most insignificant of their members," "an intriguing pharasaical individual," an utterer of "*a deliberate falsehood*," "a mendacious little individual," and "a parasite who lives by dishonouring the labours of others." The original offence of the gentleman so designated, was his differing in opinion with Mr. Featherstonhaugh respecting the organic remains of an extinct species of animal; which offence he aggravated by openly defending his opinions before the Philosophical society.

Mr. F. no doubt imagines that the *provocation* which he has received, will suffice to justify the coarse epithets, and personal abuse, to which he has resorted; we apprehend, however, that to this opinion he will make but few proselytes. He appears to have forgotten "the divine feelings of religion,"* and certainly endangers the accomplishment of his main purpose, which he tells us "is not to win opinions from a limited number of selfish individuals, more interest-

* P. 91, Journal of Geology.

ed in *humbugging* the public than in enlightening it."* We hope that when he endeavours "to instruct and amuse the millions,"* he will perceive the necessity of uttering the lessons of wisdom with the tone of a gentleman, and in the elevated language which belongs to the real philosopher.

Meteorological Observations for July, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	68°	78°	30.00	30.00	68½	SE.	Moderate.	.4	Rain--cloudy.
☾	2	69	79	.20	.00	70	SE.	do.	.6	Cloudy—rain.
	3	70	72	.20	.00	71	S. W.	do.	.11	Fog—shower.
	4	72	82	.20	.10	71	SW.	Breeze.		Fog—clear.
	5	72	83	.5	30.00	68	SW.	do.	1.00	Clear—flying clouds.
	6	71	76	29.90	29.85	68	SW.	do.	4.50	Cloudy—rain. Rain night,
	7	72	74	.80	.80	73	SW. SE.	Moderate.	.66	Cl'dy--rain. [thun.&light.
	8	70	80	.85	.85	74	SE.	do.	.90	Fog—Flying clouds.
⊗	9	72	74	.75	.75	70	SE. SW.	do.	.71	Rain night, thun. & light.
	10	57	71	.80	.90	50	W. W.	do.		Drizzle—cloudy—rain.
	11	53	71	30.10	30.16	47	NNW. N.	do.		Clear—flying clouds.
	12	53	74	.20	.20	49	W. W.	do.		Clear day.
	13	54	72	.10	30.00	51	SW. S.	do.		Clear day.
	14	63	77	29.84	29.80	60	N. W.	do.		Clear day.
	15	66	78	.75	.75	63	W. W.	Breeze.		Clear day.
☽	16	62	75	.80	.80	49	W. W.	do.		Clear day.
	17	60	78	.83	.83	57	W. W.	Moderate.		Clear day.
	18	65	79	.83	.74	69	SW.	Breeze.	.7	Clear day.
	19	72	85	.75	.75	64	W. W.	do.		Clear day.
	20	71	86	.75	.70	68	W. W.	do.	.8	Clear—shower.
	21	70	85	.70	.70	66½	W. W.	do.		Clear day.
	22	71	86	.70	.72	66	W. W.	do.		Clear day.
	23	73	85	.70	.60	70	S. S.	do.	47.	Cloudy—showery.
☺	24	70	82	.70	.80	65	W. W.	Moderate.		Clear day.
	25	63	81	.80	.83	63½	W. W.	do.		Clear day.
	26	74	80	.60	.63	66	S. W.	Breeze.	.7	Cloudy—thunder shower.
	27	72	84	.80	.90	66	W. W.	do.		Clear—overcast.
	28	73	82	.83	.80	73	W. W.	do.		Clear—cloudy.
	29	70	82	.90	30.00	61	W. W.	do.		Clear day.
	30	65	84	30.00	.00	64	W. W.	do.	.5	Clear—shower.
	31	72	87	29.92	29.90	73	SW.	do.	.15	Clear—shower.
	Mean	67.27	79.42	29.88	29.86	64.3			8.87	

	Thermometer.		Barometer.	
Maximum height during the month,	87.	on 31st	30.16	on 11th.
Minimum do. . . .	71.	on 10th and 11th.	29.60	on 23d.
Mean do. . . .	73.34	. . .	29.87	

* P. 91, Journal of Geology.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

SEPTEMBER, 1831.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the height of Water in Boilers of Locomotive Engines.

By Franklin Peale.

The gauge cocks of boilers, are certainly one of the most important parts of a steam engine; upon their indications we rely for the knowledge of the proper height of water in the boiler, and, of consequence, for the full and efficient operation of the engine; and what is of no less importance, the safety of all who may be within reach of its influence. Any facts, therefore, relative to this portion of an engine, must be acceptable to the public.

High pressure, alone, being applicable to locomotive purposes on land, our observations must be considered as applying particularly, though not exclusively, to this variety of steam power.

When a boiler, in which the steam is raised, is at perfect rest, that is to say, when the engine which it is intended to supply is not in motion, or otherwise disturbed, the surface of the water, or as it is called, the "water line," is accurately defined, and if, for the sake of illustration, we suppose that gauge cocks were placed at fractions of an inch in relative height, the position of the surface of the water would be indicated with great accuracy at the moment when the cock at the same elevation was opened, but if it is kept open, a current is established in the direction of the escape, and it is no longer a perfect indication. So true is this, that if you open a cock some distance above the surface of the water, steam only, at first, passes out, but ultimately steam and water, and the duration of the interval between the opening and the appearance of water, will depend on the relative height of the gauge cock, the surface of the water, and the degree of pressure upon the boiler at the time at which the experiment is made.

One of our papers, a few months back, contained a statement of a fact intimately connected with this subject, observed upon the trial of a model engine, and also asked for a solution of the phenomenon, which may, I think, readily be given.

The statement, if we remember rightly, says, that steam was raised in a small high pressure boiler, the safety valve of which was then lifted by hand; the steam was immediately followed by water, and ultimately the whole of the water in the boiler was expelled through the valve.

I have frequently lifted the safety valve of a small boiler, with invariably the same result; water always made its appearance after a brief interval. The solution is easy—a certain quantity of heat is contained in the water of the boiler, which, when the pressure is taken off, by the raising of the valve, is sufficient to cause the water to rise in foam, and is nothing more or less than is expressed in the language of the kitchen, by the phrase, "the kettle is boiling over."

When an engine is set in motion, and the steam thereby taken off, the ebullition necessary for a further supply, disturbs the surface of the water, and the gauge cock is no longer so decided in its indications, but requires a considerable degree of practical experience to be able to decide, from the appearance of the escaping steam and water, the precise height of the water line, but to a sufficiently practiced eye there is no difficulty. It is not so when a locomotive engine is running on a rail-way. The agitation of the engine is considerable, and a correspondent effect is produced on the water in the boiler, and it then becomes extremely difficult, if not impossible, to tell its height. This is a fact of immense importance in the management of an engine, and yet it is one that was not anticipated by men of science, and of which even practical engineers were uninformed. In company with several engineers, and other gentlemen of science, at a recent trial of a locomotive engine, I was witness to a case exactly in point; it was in action without locomotion; the wheels being raised so as to prevent adhesion; the gauge cocks all indicated water; the engine was then stopped, when, to the surprise of those present, no water was found at the lowest cock, and no human being could ascertain what was the height of water in the boiler at that time, a circumstance that should never occur, for reasons that every one who has any knowledge of the subject must know and admit.

It is much easier to state the difficulty than to devise a remedy. We have received as yet little or no assistance from our more experienced predecessors, the English. The general form and arrangement of their engines, and the results of trials with them, is nearly all we know; what we require is minute descriptions of the important parts of the engine, and full and close details of their management. Information of this character will be of the utmost utility.

At present we must rely on the care of engineers in this matter; the supply pump must be efficient in its operation; the quantity of water supplied in a given distance must be known and governed by the combined and relative velocity and load; and, above all, there must be frequent stoppages at short distances for the purpose of examination.

Careful experiment and sufficient experience may give confidence, but it is extremely desirable that the state of water in boilers should be made more evident to observation than appears to be possible with the present arrangement.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a Moving Power.

(Continued from p. 40.)

Table D.—Part I.

Chute No. 1.—*Gate c. Over-shot. Centre buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wtofwater expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	2.75	3.00	3.60	1.00	875	55.34	930.34	41.5	41	9.53	2835	23.00	652050	386091	.592	- -	- -	Much water thrown over side of wheel.
2					978	57.14	1035.14		45	8.69	3025		695750	429583	.617			Air vents closed.
3					1081	58.94	1139.94		50	7.82	3280		754400	473075	.627			
4					1184	60.74	1244.74		52	7.52	3560		818800	516567	.630			
5					1287	65.11	1352.11		57	6.85	3850		885500	561126	.634	.634	6.86	
6					1390	69.48	1459.48		61	6.40	4180		961400	605684	.630			
7					1493	73.85	1566.85		65	6.01	4500		1035000	650243	.628			
8					1596	78.22	1674.22		71	5.50	4850		1115500	694801	.623			
9					1699	82,59	1781.59		79	4.95	5280		1214400	739360	.609			
10	2.75	3.00	3.60	1.25	1596	78.22	1674.22	41.5	59	6.62	4850	23.00	1115500	694801	.623	.623	6.62	Much water wasted.
11					1699	82.59	1781.59		63	6.20	5175		1190250	739360	.611			
12					1802	86.96	1888.96		67	5.83	5550		1276500	783918	.614			
13	1.25	1.50	2.10	1.25	1184	60.74	1244.74	41.5	69	5.66	3750	21.50	806250	516567	.640	6.40	5.66	
14					1287	65.11	1352.11		76	5.14	4125		886875	561126	.632			
15					1390	69.48	1459.48		79	4.95	4440		954600	605684	.634			
16	0.75	1.00	1.60	1.50	978	57.14	1035.14	41.5	58	6.73	3125	21.00	656250	429583	.654			
17					1081	58.94	1139.94		63	6.20	3400		714000	473075	.662			
18					1184	60.74	1244.74		69	5.66	3690		774900	516567	.666	.666	5.66	
19					1287	65.11	1352.11		76	5.14	4075		855750	561126	.656			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE D.—PART II.

CHUTE NO. 1.—*Gate c. Over-shot. Centre buckets. Close breast. Water let on at upper centre of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	0.50	0.75	1.35	1.50	875	55.34	930.34	41.5	68	5.75	2925	20.75	606937	386091	.636			
21					978	57.14	1035.14		75	5.21	3200		664000	429583	.646			
22					1081	58.94	1139.94		84	4.65	3500		726250	473075	.651	.651	4.65	
23	0.50	0.75	1.35	2.00	875	55.34	930.34	41.5	60	6.51	2900	20.75	601750	386091	.641			
24					978	57.14	1035.14		67	5.83	3150		653625	429583	.657			
25					1081	58.94	1139.94		75	5.21	3450		715875	473075	.660	.660	5.21	
26					1184	60.74	1244.74		84	4.65	3775		783312	516567	.659			
27	2.75	3.00	3.60		772	53.54	825.54	4.51	40	9.17	2650	23.00	609500	342599	.562			Air vents open.
28					875	55.34	930.34		42	9.30	2885		663550	386091	.582	.582	9.30	
29					978	57.14	1035.14		48	8.14	3225		741750	429583	.579			
30					1081	58.94	1129.94		53	7.37	3560		818800	473075	.577			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table E.—Part I.

Chute No. 2.—*Elbow buckets. Close breast. Bottom of gate seventeen feet above bottom of wheel.*

No. of Exper't.	Head of water above.			Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Btm. of gate.	Top of bkt.	Btm. of bkt.															
	Feet.	Feet.	Feet.	In.'	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	6.00	7.66	8.82	0.25	463	47.99	510.99	41.5	56	6.98	1750	23.00	402500	212061	.527			
2					566	49.76	615.76		50	7.82	2025		465750	255540	.548			
3					669	51.57	720.57		56	6.98	2350		540500	299020	.553			
4					875	55.03	930.03		62	6.30	3000		690000	385979	.559	.559	6.30	
5					1184	60.38	1244.38		90	4.35	4100		943000	516418	.547			
6					1287	64.74	1351.74		107	3.65	4575		1052250	516567	.533			
7	6.00	7.66	8.82	0.50	1287	64.74	1351.74	41.5	60	6.51	4050	23.00	931500	560972	.602			
8					1390	69.11	1459.11		53	7.37	4275		983250	605531	.616			
9					1493	73.48	1566.48		56	6.98	4600		1058000	650089	.614			
10					1596	77.85	1673.85		58	6.73	4900		1127000	694643	.617	.617	6.98	
11					1699	82.22	1781.22		63	6.20	5250		1207500	739206	.612			
12					1802	86.59	1888.59		68	5.75	5600		1288000	783765	.608			
13					1905	90.96	1995.96		72	5.43	5975		1374250	828323	.602			
14					2008	95.33	2103.33		87	4.49	6525		1500750	872882	.581			
15					2111	99.70	2210.70		95	4.11	6875		1581250	917440	.580			
16					2214	104.07	2318.07		104	3.76	7340		1688200	961999	.569			
17					2317	108.44	2425.44		112	3.49	7825		1799750	1006557	.559			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE E.—PART II.

CHUTE No. 2.—*Elbow buckets. Close breast. Bottom of gate seventeen feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
18	3.75	5.41	6.57	0.25	463	47.99	510.99	41.5	47	8.31	1775	20.75	368312	212061	.576			
19					669	51.53	720.53		58	6.74	2400		498000	299020	.600	.600	6.74	
20					875	55.07	930.07		80	4.87	3125		648417	385979	.595			
21					978	56.84	1034.84		88	4.44	3475		721062	429458	.595			
22					1081	58.61	1139.61		98	3.99	3850		798875	472938	.589			
23					1184	60.38	1244.38		112	3.49	4275		887062	516418	.582			
24					1287	64.74	1351.74		127	3.08	4685		972137	560972	.577			
25	3.75	5.41	6.57	0.50	1287	64.74	1351.74	41.5	67	5.83	4225	20.75	876687	560972	.639	.639	5.84	
26					1390	69.11	1459.11		78	5.01	4650		969875	605531	.624			
27					1493	73.48	1566.48		90	4.35	5100		1058250	650089	.614			
28					1699	82.22	1781.22		90	4.35	5875		1219062	739206	.604			
29					1905	90.96	1995.96		102	3.83	6675		1385063	828333	.598			
30					2008	95.33	2103.33		116	3.37	7185		1490887	872882	.585			
31	0.75	2.41	3.57	0.50	463	47.90	510.99	41.5	43	9.09	1725	17.75	306187	212061	.692			
32					669	51.53	720.53		57	6.86	2350		417125	299020	.717			
33					875	55.07	930.07		75	5.21	2975		528062	385979	.731	.731	4.88	
34					978	56.84	1034.84		89	4.40	3325		590187	429458	.727			
35					1081	58.61	1139.61		95	4.11	3685		654087	472938	.723			
36					1184	60.38	1244.38		109	3.95	4050		718875	516418	.718			
37					1287	64.74	1351.74		121	3.22	4425		785437	560972	.714			
38					1390	69.11	1459.11		122	3.20	4810		853775	605531	.709			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE E.—PART III.

CHUTE NO. 2.—*Elbow buckets. Close breast. Bottom of gate seventeen feet above bottom of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Seds.	Feet.	Pds.	Feet.						
39	0.75	2.41	3.57	0.75	1390	69.11	1459.11	41.5	90	4.35	4790	17.75	850225	605531	.712	.712	4.35	
40					1493	73.48	1566.48		103	3.79	5200		923000	650089	.704			
41					1596	77.85	1673.85		111	3.52	5575		989562	694643	.701			
42					1699	82.22	1781.22		118	3.31	5960		1057900	739206	.698			
43					1802	86.56	1888.56		126	3.10	6310		1120025	783752	.699			
44	0.75	2.41	3.57	1.00	1802	86.59	1888.59	41.5	99	3.95	6400	17.75	113600	783765	.690			
45					1905	90.96	1995.96		108	3.62	6575		1167062	828323	.709	.709	3.62	
46					2008	95.33	2103.33		111	3.52	7075		1255812	872882	.695			
47					2111	99.70	2210.70		117	3.34	7475		1326762	927440	.691			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE F.—PART I.

CHUTE NO. 2.—*Centre buckets. Close breast. Bottom of gate seventeen feet above bottom of Wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Head of Water above. Top of Bkt.	Head of Water above. Btm. of Bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	6.00	7.66	8.82	0.50	669	51.53	720.53	41.5	37	10.56	2775	23.00	638250	299020	.468			
2					772	53.30	825.30		39	10.02	3110		715300	342499	.478			
3					875	55.07	930.07		43	9.09	3435		790050	385979	.488			
4					978	56.84	1034.84		49	7.98	3725		856750	429458	.501			
5					1081	58.61	1139.61		56	6.98	4030		926900	472938	.510			
6					1184	60.38	1244.38		60	6.50	4350		1000500	516418	·516			
7					1287	64.74	1351.74		59	6.62	4570		1051100	560972	.533			
8					1390	69.11	1459.11		57	6.86	4800		1104000	605531	.548	.548	6.86	
9					1493	73.48	1566.48		68	5.75	5175		1190250	650089	.546			
10					1596	77.85	1673.85		76	5.14	5825		1339750	694643	.518			
11					1699	82.22	1781.22		81	4.83	6230		1432900	739206	.515			
12	3.75	5.41	6.57	0.50	978	56.84	1034.84	41.5	51	7.66	3800	20.75	788500	429458	.544			
13					1081	58.61	1139.61		57	6.86	4150		861125	472938	.549			
14					1184	60.38	1244.38		71	5.50	4525		938937	516418	.550			
15					1287	64.74	1351.74		66	5.92	4820		1000150	560972	.560	.560	5.92	
16					1493	73.48	1566.48		82	4.77	5675		1177562	650089	.552			
17	3.75	5.41	6.57	0.75	1081	58.61	1139·61	41.5	46	8.50	4025	20.75	835187	472938	.566			
18					1390	69.11	1459·11		60	6.50	5025		1042687	605531	.580	.580	6.50	
19					1493	73.48	1566.48		65	6.01	5475		1136062	650089	.572			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE F.—PART II.

CHUTE No. 2.—*Centre buckets. Close breast. Bottom of gate seventeen feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	0.75	2.41	3.57	0.50	772	53.30	825.30	41.5	86	4.54	3525	17.75	625687	342499	.544			
21					875	55.07	930.07		86	4.54	3850		683375	385979	.564			
22					978	56.84	1034.84		88	4.44	4200		754500	429458	.576	.576	4.44	
23					1081	58.61	1139.61		111	3.52	4775		847562	472938	.555			
24	0.75	2.41	3.57	0.75	978	56.84	1034.84	41.5	71	5.50	4200	17.75	745500	429458	.576			
25					1081	58.61	1139.61		73	5.35	4425		785437	472938	.602	.602	5.35	
26					1184	60.38	1244.38		88	4.44	5025		891937	516418	.578			
27	0.75	2.41	3.57	1.00	978	56.84	1034.84	41.5	58	6.74	4025	17.75	714437	429458	.601	.609	5.75	
28					1081	58.61	1139.61		64	6.10	4420		784550	470938	.602			
29					1184	60.38	1244.38		68	5.75	4775		847562	516418	.609			
30					1287	64.74	1351.74		83	4.71	5325		945187	560972	.593			
31	0.75	2.41	3.57	1.25	978	56.84	1034.84	41.5	50	7.82	4075	17.75	723312	429458	.595			
32					1081	58.61	1139.61		58	6.74	4350		772125	472938	.611			
33					1184	60.38	1244.38		62	6.30	4750		843125	516418	.612			
34					1390	69.11	1459.11		67	5.84	5400		958500	605531	.631	.631	5.84	
35					1493	73.48	1566.48		77	5.07	6000		1065000	650089	.610			
36	0.75	2.41	3.57	1.50	1390	69.11	1459.11	41.5	45	8.70	5300	17.75	940750	605531	.643			
37					1493	73.48	1566.48		48	8.14	5700		1011750	650089	.642			
38					1596	77.85	1673.85		51	7.66	6050		1073875	694643	.646			
39					1699	82.22	1781.22		55	7.10	6450		1144875	739198	.645			
40					1802	86.59	1888.59		57	6.86	6760		1199900	783675	.653	.653	6.86	
41					1905	90.96	1295.96		63	6.20	7225		1282437	823323	.645			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

An examination of the allegations made under the signature of "Justice," *respecting the patents for a Percussion Cannon Lock, obtained by Joshua Shaw, and by Lieutenant Bell.—By* Joshua Shaw.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—In the Journal of the Franklin Institute, May, 1831, I find a reply to my observations touching the conduct of Lieut. W. H. Bell, in relation to a patent taken out by that gentleman for a percussion cannon lock, &c. signed "Justice," which I think I shall be able to prove, in the course of the following remarks, to have been a most unappropriate title. In commenting upon this gratuitous article, I will not, in imitation of this *friend in need*, attempt to divert attention from the main question, by statements not the less mischievous, because told with apparent simplicity and truth; and which, until refuted, might be supposed to furnish a direct disproval of my general charges against Lieut. Bell. If, in making them, I have not been sufficiently explicit, I will now repeat them in more definite terms. I said that Lieut. Bell had infringed my patent right, and I now further say, that he has compromised the good faith, and violated the pledge of the government of the United States towards me, notwithstanding he "*belongs to a profession which tolerates no dishonourable conduct in any of its members.*"

It is easy to make charges and quite as easy to deny them, and little room may be required for either, except where the statements controverted require to be supported by reference to veritable documents, which, under present circumstances, it is indispensable upon me to do; but I will be as brief as possible, touching only upon those statements which may seem, until analysed, to refute my imputations against Lieut. Bell.

In the first place, Justice states that Lieut. Bell, is "*now absent at a remote station, where he may not, for a long time, meet with these foul aspersions on his character.*" It is believed that the Lieutenant, at the time the No. containing my charges against him appeared, was in Norfolk, Virginia; was, about the time his defence was undertaken, in Washington, on his way to Philadelphia; and was shortly afterwards, and is now, stationed at the Delaware Breakwater.—Secondly, Justice says, "that Lieut. Bell applied to me," *as a manufacturer of percussion primers, to procure a number of these articles, made according to a particular pattern, but which he did not obtain.* But why he did not, is not mentioned; at the proper time I may explain the secret, although I do not conceive it important to the point in question. In continuance he says, "*this occasion was certainly the first*, and it is believed the only one, *on which Lieut. Bell ever saw Mr. Shaw.*" This I assent to, and beg particular attention to the words Justice has marked in italics, as claiming especial notice; this meeting, we are told, occurred on the 18th day of April, 1829—this is indeed valuable information to me, as it fixes the time, and furnishes data very important should this dispute be

ever argued in a court of law, should such evidence be there deemed admissible; it is indeed a two edged sword put into my hands, as I shall hereafter show the inconsistency of this visit of Lieut. Bell.

It is further said by Justice, that "*the instrument for which Lieut. Bell has obtained a patent, was made and applied in the manner directed in his specification on, or before, the* 13*th of October*, 1828, *more than seven months prior to the interview with Mr. Shaw.*" That "*the merits of the instrument were successfully demonstrated on that day, and the trial of it was continued on subsequent days, for several weeks, and until it had fired a cannon one thousand times,*" *&c.*

It does not perhaps occur to the reader how convenient in this stage of the dispute it was for the gentleman to call the lock and its appendages an instrument, in place of an invention;—an instrument cannot be patented without it be capable of some new employment or useful purpose,—the principle was known and discovered by myself, the instrument was only employed to produce the effect, and this was the view taken by the Board of Ordnance, as will appear from a letter to me, from Col. J. Bomford, President of the Board, bearing date October 8th, 1824, and which I shall give verbatim before I close this article. I repeat that it was a happy expedient to call it an instrument, and keep out of sight any other term, as if the merits rested alone upon the lock, rather than the combinations and materials acting in concert with it. I have innumerable evidences in my possession signed Col. Geo. Bomford, authorized by the Secretary at War, which go to prove that the mode of acting upon the primer was not viewed as material, the object was to effect it by the simplest possible means; by a hammer, for example, if found convenient, and which might be retained in the hand. And the letters referred to go to prove that the authorities at Washington viewed the whole affair in this light; they solicit my confidence, and assure me that they admit the value of my discovery, and that in obtaining possession of all the necessary information, and *instruments*, which I placed at their disposal, their only object was to determine for themselves, by actual experiment, the best mode of applying the principle, and then to afford *me* the advantages of these results, as the effect of my invention.

Justice has said that Lieut. Bell had determined in practice the merits of his instrument, more than seven months prior to his call upon me for primers, and that he actually fired it a thousand times, and, of course, had used 1000 primers; how happened it, if Lieut. Bell could furnish himself with 1000 primers, that he should call on me for so small a quantity as three or four hundred, for it must be observed, that the primer and its application, is, as it were, the essence, and constitutes one of the principal merits of the invention. Now, if he could supply himself with the larger, surely he could have supplied the smaller quantity. It is also stated, that there is one material difference between the two instruments, meaning mine and Lieut. Bell's, which is, that when applied to "*the purposes for which both are alike designed*, the one never fails, the other never succeeds." Really any person who had a spark of modesty, or re-

gard for truth, must, upon reading this assertion, blush for the profession which tolerates nothing dishonourable in any of its members; an assertion which is, as I think I shall prove, irrefutably contradicted by the minutes taken by officers appointed to preside during experiments made at different times, by order of the Board of Ordnance, at various and very distant dates, duplicates of which I now hold in the hand writing of the officers so appointed. Other numerous experiments were made in the presence, and under the direction of the highest officers in the Navy Department, to whom the declaration made by JUSTICE would imply an insult, inasmuch as it would pursuade us, that the Navy Commissioners had been throwing away the public treasure upon a worthless and totally useless affair, without common prudence or reflection, or the least regard for the public service over which they have control. The next statement which I shall notice is yet more absurd; if correct, it would implicate gentlemen of the first respectability in Washington, as being guilty of the basest duplicity, and would lead to the supposition, that they had been leagued with me, to impose upon the government by false representations, &c., for if it be on official record, that this invention of mine was communicated to me more that eight years ago, what ignorant and misjudging individuals must preside over the public interests at Washington, who, being in possession of these facts, would yet cause such numerous and expensive experiments to be carried on from time to time, and during more than two administrations since 1823. I really feel ashamed to argue such points, as they are altogether of such a character as to merit little notice from any but those who will not think for themselves, and such as believe in any thing they are told. If it be true that the inventions claimed by me were suggested by others, what shall be said of those claims set up by Lieut. Bell, who was, confessedly, put into possession of materials for the purpose of experimenting upon them, for objects which were agreed upon and understood between the Board of Ordnance and myself, and defined by words as clear and unequivocal as common sense could well suggest, as I shall soon show: Lieut. Bell was at this time an officer in the service, receiving his pay as such whilst engaged in these experiments upon my invention,—now it is a point long since decided by the courts, that if any person in the employment of another, make any discovery predicated upon such employment, and growing out of it, while so employed, it belongs to the principal, (the employer,) and was so acted upon in a case in which Fairman & Perkins were concerned against one of their workmen. Now admitting, for the sake of the argument, that the record does exist, it must apply alike to both of us, or it was no record at all. There is, however, this difference between us, I had been labouring hard for years, without remuneration, expending several thousand dollars, while he, in the pursuance of his experimental duty, was paid from day to day for his labour: perhaps JUSTICE in his zeal did not perceive that in this attempt to assault me, he dealt a blow at his friend likewise.

I deny that information was ever conveyed to me from any quar-

ter that furnished *any*, even the most distant, hints of my invention. I must have been singularly unwise indeed, to have laboured so intently, and so long, to arrive at that conclusion, which was an *official record.*

I now submit, in support of my statements, written facts, in evidence, and which are at the command of any who may be disposed to call and examine for themselves. The first I shall refer to is the minutes of experiments made at Frankford, by order of the Board of Ordnance, Nov. 20, 1823. The result was successful and approved by the Board, and the idea acknowledged to be originally suggested by me, in a communication I received signed by Col. Geo. Bomford, on ordnance duty, in which he says, that the Secretary of War had referred my application to him, to the Ordnance Department, &c. Then comes minutes of experiments made on the 19th day of May, 1825, by order of the Board; presiding officer Lieut. Baird; also at Frankford, on an 18 pound gun, the powder cased in three thicknesses of flannel, with a view to test this discovery, and prove its efficiency to perform a duty two-thirds greater than was required in actual service, and the result was, that with every disadvantage incidental to new discoveries, the gun was fired fourteen times in regular succession; it was then proposed to soak the primers 15 minutes in water, it failed twice to take effect in consequence of the water saturating the primer; a dry primer was then tried, which succeeded. I have, however, since rendered these primers proof to a soaking of 15 minutes in water, and tested them in the presence of Commodore Bainbridge at the Navy Yard, in Philadelphia, on a 24 lb. gun, intended for the Vandalia, who, shortly afterwards, had all her guns mounted with my locks, which, during a cruise of more than two years, on the South American station, have given entire satisfaction; which information I have received from different officers resident in Philadelphia. The fitting out of the Vandalia with my locks was experimental, and it is not to be supposed, that new instructions would have been given me from time to time to manufacture others, if the first had not given ample satisfaction. A few words more and I have done; it must not be forgotten that Lieut. Bell was specially employed by the Board of Ordnance, to carry on a series of experiments upon the principle of my discovery, the object of which was, to come at the most convenient mode of adapting it in the service of the United States, as my vouchers will show; but this gentleman was not satisfied with the honour thus conferred upon him, and believed, as I suppose he did, that any change in the arrangement of the means employed, would confirm the right in him, and thus enable him to reap the harvest due to me.

I shall now offer copies of two letters, which will speak for themselves, and will then close this uninteresting dispute with a very few further remarks.

Ordnance Department, *Washington, October* 3, 1824.

Mr. Joshua Shaw, *Philadelphia,*

Sir,—Your letter of the 11th ult. was duly received. Col. Bom-

ford is at present absent from the city, but before his departure he instructed me to inform you that he was desirous of giving a further and more extensive trial to your percussion primers for cannon, and for this purpose wishes to obtain a considerable number of them, say 1000 at least. From trials already made, strong hopes are entertained that the results will be satisfactory. As a preliminary, however, to the adoption of this method of firing cannon, the department must possess the means of making the primers at the arsenals. It is therefore proposed to you to furnish a machine, with all the necessary directions for making the primers, together with a small supply of the primers made by yourself, and a suitable lock for firing them, for all which the department will pay whatever may be a reasonable compensation for your time, services, and expenses, provided the whole amount shall not exceed three hundred dollars.

If you accede to this proposition, *the machine, and other means which you may furnish,* will be received by the department *under a pledge* that they shall be used *for no other purpose than that of making experiments to test their value and usefulness in service.* If, after a sufficient trial, it shall be determined to adopt the primers, the department will then enter into such further agreement with you, as may be satisfactory to both parties. You will perceive that the above proposition calls for nothing more than possession of the *requisite means* for ascertaining the real merits of the invention, with a view to its adoption or rejection, as the case may be.

Respectfully, I am, Sir,

Your ob'nt serv't,

W. WADE,

Captain on Ordnance Duty.

Now, if this was the only letter explaining the nature of the assurances made to me, some doubts might perhaps exist as to the full extent and meaning of the letter here given; but as I have numerous others, all tending to show, that it was not the *instrument*, but the *invention*, taken as a whole, that was valuable, and which my patent either does or was intended to cover, and also showing that the sole object of the Board was to vary the experiments, with such means, and aided by such information, as I could suggest, until they should be able to *adopt or reject it.* I solemnly declare that I did, at least nine or twelve months, before Lieut. Bell called upon me, inform Col. Bomford, verbally, of what I had invented in respect to *clearing the ventfield of all obstruction.* Indeed I had calculated upon this improvement from the first moment, and if any one will examine my specification, they will find positive evidence of it; I quote the passage I allude to; it is in the third division of the specification; having described the lock, as adopted by the Navy Commissioners, I go on to state, that amongst other advantages and modifications, that it can be so changed or modified, *as to leave the sighting and the ventfield clear.* This patent was secured on the 24th day of October, 1828, and will tend to prove that the very materials and information which I had furnished, and which were to be experimented on, as it

were in trust for me, under pledges, the nature and bearings of which cannot be misunderstood, was insidiously taken away from me, and is placed to the account of Lieut. W. H. Bell. Now, it must appear that this friend was really unacquainted with all the particulars which he pretended to understand, or was determined to conceal material facts. In *any* case, his statements are an aggravation of the wrong already inflicted upon me; and if the latter motive prevailed, he has identified himself with the guilty party.

The following is a copy of a short letter received from Commodore Bainbridge:

Mr. Shaw having invented a Percussion Cannon Lock, and exhibited the same for experiment at this yard, which experiment was satisfactorily made in the presence of myself and several officers of the navy; and the lock, by recommendation, adopted in our naval service, as being very superior to any cannon lock heretofore used: since then, Mr. Shaw has made an improvement on his first lock, and it is now probably as perfect as a thing of that kind can be made.

(Signed,) Wm. Bainbridge.

Dated at the Navy Yard, Philadelphia, 15th April, 1829.

On the 7th January, 1831, a Military Committee, appointed by Congress, made a report respecting an application of mine, the purport of which is not material here; but there is a passage in it, which I shall quote, that has an immediate bearing upon the present question. It runs thus:

"It appeared to the Committee, by the concurrent testimony of officers of the highest respectability in the navy and the army of the United States, that the memorialist had not overrated his merits, and that he was justly entitled to the reputation of great ingenuity, judiciously applied to an important military object," &c.

I now submit it to a candid public, whether I have, or have not, sustained my charges against Lieut. Bell? and also, whether Justice, who says it is the duty of a friend, "*to whom all the material facts of the case are known, to lay a brief statement of them before the readers of the Journal,*" has, or has not told the truth, the whole truth, and nothing but the truth.

Should Justice think proper to make any rejoinder, it will be necessary for him to do so under the sanction of his proper name; as I shall not, hereafter, reply to any charges, or attack any defences, set up by an anonymous writer.

I remain, Sir, yours,

Joshua Shaw.

Philadelphia, July, 1831.

Remarks by the Editor.—This Journal is intended for the promotion of general information; in endeavouring to attain this end, individuals will sometimes feel themselves aggrieved, and will have some just claim to be heard through the medium of our pages. So long as a discussion is calculated to unfold the truths of science, it may be

legitimately continued, if not too much wiredrawn; when, however, the dispute becomes merely personal, and is incapable of adjustment excepting by a court and jury, the public will cease to partake of that interest with which the combatants may be animated, and it is then time to seek a new arena. Such, we think, is the state of the present contest. Common courtesy, however, demands that Lieut. Bell, or his friend, Justice, should be heard in reply to the preceding. But, let it be remembered, that "brevity is the soul of wit."

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Oiling Rail-way Carriages.

Sir,—There is no difficulty in oiling axles continually, but to do it so as not to waste a drop of oil, has not been done, I believe, till the latest improvements in the friction saving carriage of the Baltimore rail-road, where very accurate experiments have been making by Mr. Geo. Brown, one of the principal proprietors in that work; the result of which, he informs me, is, that one quart of oil will be sufficient for 2000 miles run of a carriage, which, with its load, weighs three tons. He informs me at the same time, that he has ascertained, that the Lehigh rail-way carriages consume four quarts in running 821 miles with one ton. This you will perceive is nearly *thirty times as much.*

The manner of oiling the Winan's wagon is peculiar to its construction as now improved. The secondary wheels now run in a cast iron case, the top of which is formed so as to affix to the under surface of the side timbers of the frame of the wagon. Its sides sustain the axle and are supported or joined by an intermediate part or bottom, which forms a tight case, into which the oil is put, so that the friction wheel dips into it, and its rim carries up a little of it continually to the rubbing and rolling surfaces, returning it to the reservoir; thus oiling its own axle where all the rubbing is situated, and the rolling axle, and no more is *consumed* than *evaporates.* Its enclosure keeps it clean.

I need not remind you that the use of oil on axles is not only to keep the surfaces from absolute contact, and grinding together, but to keep them cool, and this is better done by the successive application of new portions of oil, than by keeping the same oil on the axle as long as it will last, partaking of the heat the axle acquires, and therefore evaporating the faster. This method must therefore be of consequence when great velocity is to be given to heavy loads.

Respectfully, yours, &c.

J. L. Sullivan.

FRANKLIN INSTITUTE.

Monthly Meeting.

At a stated monthly meeting of the Franklin Institute, held at their Hall, July 28th, 1831.

THOMAS FLETCHER, Esq. Vice President, in the chair, and ALGERNON S. ROBERTS, Secretary, *pro. tem.*

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute.

By Mr. Robert S. Gilbert.

The Cabinet of Natural History and American Rural Sports.

By Messrs. Carey & Hart.

The Working Man's Companion. The Results of Machinery, namely, Cheap Production and Increased Employment exhibited; being an Address to the Working Men of Great Britain.

The corresponding secretary laid upon the table the following works received in exchange for the Journal of the Institute—

London Journal of Arts and Sciences, for June.

The Repertory of Patent Inventions, for April and June.

London Mechanics' Magazine, for May.

The Register of Arts and Journal of Patent Inventions, for April and June.

Recueil Industriel, for February.

Bibliothéque Physico-economique, for April.

Annales de Chimie et de Physique, for January.

North American Review, for July.

American Annals of Education and Instruction, for July.

Museum of Foreign Literature, Science, and Arts, for July.

American Journal of Geology and Natural Science, for July.

The Illinois Monthly Magazine, for June.

The committee on Inventions presented a report on D. L. Smith's planeing machine, which was read, and, on motion, referred to the committee on publication.

On motion, the subject proposed for discussion this evening was postponed until the next monthly meeting, and then adjourned.

THOMAS FLETCHER, *Vice President.*

ALGERNON S. ROBERTS, *Sec. P. T.*

Report of the Committee on Inventions, of the Franklin Institute, on DANIEL L. SMITH'S *Revolving Timber Plane.*

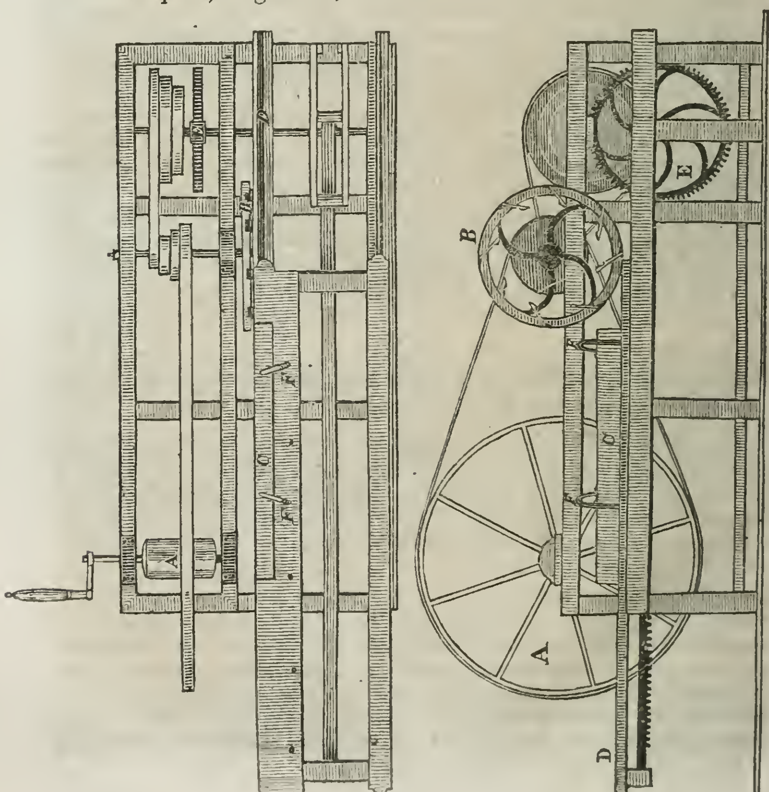
THIS machine, of which drawings and explanations are appended, consists of a frame of sufficient length to support the timber to be planed, having a sliding carriage upon it moved by a rack and pinion, on metal guides, upon which the timber is secured by hold-fasts. This frame is made to pass before the face of a cast iron wheel, furnished with plane irons, which revolves with rapidity, receiving its motion through a strap from a belt wheel in the hand machine, or driving pulley; the rack pinion taking its motion from the shaft of the plane wheel. On the face of the cast iron wheel are fixed four plane irons. Two of them single for roughing down the work, each followed by a double iron projecting a little beyond the first pair for finishing, all carefully adjusted so as to cut the face of the timber exactly square with the carriage on which it rests. The roughing

irons extend further from the centre of the wheel than the other pair, and their ends made round with cutting edges to enable them to take off any projections on the wood which could not be removed by the faces, and reduces the wood, at one operation, to the full breadth of the iron, say from half an inch to one inch. To cut the timber to any bevel it must be set on the frame to the required angle, and secured by wedges on the outside.

This machine differs from Woodworth's, inasmuch as the cutters are secured to the face of the wheel, instead of the periphery, and is not furnished with secondary planes for tongueing and grooving.

The committee witnessed several trials on a model which was laid before them, and afterwards on a large machine in Kensington, where it performed its work with expedition and accuracy—the timber was square maple and cherry, from which the irons at once cut a chip three-fourths of an inch thick. As the cutters move across the grain of the wood, it is probable that unless the edges are kept exceedingly sharp, smooth work could not be performed on soft spongy wood, but they recommend it as a valuable addition to the machine maker's shop, or to others who work in the harder woods.

Philadelphia, August 25, 1831.



AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1831.

With Remarks and Exemplifications, by the Editor.

[* Continued from p. 127.]

55. For an improvement in the *Grist Mill*, called a self-stopper; Robert M'Cormick, Jr., Augusta county, Virginia, April 20.

Within the ordinary hopper, there is a secondary, or false hopper, exactly fitting the former on every side; this false hopper is placed at the lower part of the true one, and may extend up, probably, one-third of its height. The false hopper is attached to a cord, which passes over a pulley with a weight sufficient to raise it when not held down by the grain within it. When nearly all the grain has run out of the hopper, the weight descends, and by a connexion established between it and the gate arm, stops the mill.

The claim is to "the false hopper, the lever, &c. by which it is suspended, the weight, as constructed, and the channel in which it plays up and down; the horizontal rod as connected to the shoe, and the combination of the several parts."

---

56. For a *Washing Machine;* John Hale, Hollis, Hillsborough county, New Hampshire, April 20.

We really believe this to be a washing machine of a new construction, which, numerous as are the patents taken for such instruments, is a thing of rare occurrence. A washing tub is to be made in the form of the troughs of those mills for grinding apples, bark, and other articles, in which a stone rolls round. In other words, take a tub three and a half feet in diameter, and another of two feet in diameter, place the last within the other, bottom upwards, and you have the form of the annular washing tub described in the specification. A vertical shaft is to pass through the centre of this tub, and to be supported by pivots, in a proper frame, so that the tub will revolve freely in a horizontal direction. A roller of 18 inches in diameter is fixed upon a shaft in the frame, and when turned by a crank it revolves within the annulus, or circular trough, touching its bottom. This roller is the frustrum of a cone, to which the bottom of the trough is adapted to cause it to act regularly. The lower pivot of the main shaft rests upon a moveable lever, under the tub, and is sustained by a weight, or spring, to allow the tub, as it revolves, to adapt itself to the varying thickness of the clothes. The motion is to be slow, to effect which a pinion on the crank shaft takes into a wheel on the shaft of the roller.

The claims are to "the annular form of the tub, with its advantages of rising and lowering according to the irregular thickness of the clothes spread therein to be washed; and the advantages obtained by the speed of the washer, which facilitates the operation."

57. For an *Upright Toggle-joint Press;* John Hale, Hollis, Hillsborough county, New Hampshire, April 20.

This is a standing press, with a bed piece, cheeks, and caps, made in the usual manner. There are two toggle-joints attached by their upper ends to the cap piece, and by their lower ends to the platten, or follower, the knees of the joints receding from each other: when in use they are to be drawn together by a rope, for which purpose they have sheaves fixed in the joint pieces, running upon pins within mortices made in them; through these a rope is reeved. A windlass attached to one of the cheeks of the press is used to draw this rope. The claim is to the application of the several pulleys, or sheaves, to the toggle-joints; and the application of ropes."

There are but very few objects to which such a press is applicable. The toggle-joint being peculiarly adapted only to the purpose of traversing a small distance, with the exertion of immense power at the end of its short range. Where goods are to be pressed the conditions are very different, and such as this press will not fulfil.

---

58. For a *Polishing and Graining Machine,* for Morocco and other leather; Robert Emes, Boston, Massachusetts, April 20.

A wheel, which may be of iron, and eleven feet in diameter, is made to revolve upon gudgeons, like a fly wheel; a stout base, or foundation of stone, lies under this wheel, a part of it being cut into the form of a segment suiting the diameter of the wheel. This part may be faced with iron, and forms the bed upon which the leather is to lie, in order to its being diced, or polished. The flints for polishing, or the blocks for dicing, are fixed upon six rods upon the periphery of the wheel; these rods slide in sockets so that they can retreat, and are borne out by spiral springs, that the requisite pressure may be made upon the leather.

"What I claim herein as new, and of my own invention, is the wheel aforesaid, with the apparatus thereto fixed when applied for holding and carrying a flint polisher, and operating therewith on morocco, or other leather, to polish the same, and for holding and carrying a dicing ball or block, and operating therewith upon morocco or other leather, to dice or grain the same, and the flint when used and applied as aforesaid, with the said wheel and its apparatus for holding the same, for the polishing of morocco and other leather."

At p. 200, vol. 3, there is an account of a similar machine, patented by Abel Bayrd, of South Reading, Massachusetts, on the 29th of December, 1828. If there is any thing different in the principle of the two machines, we are unable to discover in what this difference consists. The last mentioned patentee refers to one obtained by Mr. Jacob Perkins, in the year 1809, for the same purpose, which he in part adopted, taking his patent for an improvement thereon.

---

59. For a *new Material for Sheaves of Blocks;* Caleb Curtis and Thomas C. Smith, Boston, Massachusetts, April 20.

"The stone ware sheave, made of clay, and the materials usually

employed in the glazing of stone ware, pottery, or glass ware, to be used in the same manner and for the same purposes as lignumvitæ and iron sheaves are now used."

These sheaves are undoubtedly very good, when well made; this, we believe, has been proved in England; as we recollect sometime since, seeing them mentioned in one of the journals; although this fact may militate against the validity of the patent, it will not affect the goodness of the pulley.

---

60. For a *Churn;* David Smith, near Emmitsburg, Frederic county, Maryland, April 21.

A trough is made, the excavation in which is to be semi-cylindrical. In this trough dashers are to revolve backward and forward, they being fixed upon an axle for that purpose. A cover is to be keyed down over the dashers, to prevent the waste of cream. It is to be worked by a lever, there being a pinion on the dasher shaft, and a segment of a wheel on the fulcrum of the lever. The claim is to "*the mode of keying the top to the bottom;* the inclined dashers, and the mode of working them."

---

61. For an *Improvement in the Power Loom;* Jesse Taylor and Joseph Woodhead, Middletown, Pennsylvania, April 21.

The exact structure of the part patented, cannot be given without a drawing; but its object and operation are thus explained:

"When the thread of the filling or weft breaks, the spring acts by the lathe's striking against the breast beam, and the finger [a part so called] pressing on the lever, lets off the gearing rod, and suffers it to slide along the mortice; it then throws the strap from a fixed to a loose pulley; thus stopping the operation of the weaving."

The claim is to the "stopping of the power loom when the filling breaks, by the machinery itself, without the aid of hand."

---

62. For an *Improvement in Tanning;* Isaac Daws, Goshen farm, Montgomery county, Maryland, April 21.

The directions given are, after the hides have been haired and fleshed, to hang them in bates, upon pegs or nails, very close together, until fit to work in the bark: clean and rince them, hang them in tan vats upon pegs or nails, in a weak sour liquor, for two or three days; hang them next in a stronger liquor for four or five days. Make a very strong liquor of black oak bark; for a vat of thirty hides, add one pound of Glauber's or other salt; add three bushels of bark at the bottom, and one at the top of the vat; in this hang the hides for three weeks, covering the vats up to prevent evaporation.

On removing the hides, the liquids will answer as weak liquids.

The claim is to the foregoing process, by which leather can be tanned in less time, with less labour, and be equally good with that tanned in the ordinary way.

---

63. For a *Washing Machine;* John G. Conser, Miles township, Centre county, Pennsylvania, April 21.

There is no claim to this machine; and it is so old fashioned, that we have met with it repeatedly, and do not, from our acquaintance with it, think it worth introducing again to our friends.

---

64. For an improvement in *Teaching the Art of Performing on the Violin;* Robert M'Cormick, Augusta county, Virginia, April 21.

Not being adepts in music, we will not attempt a particular analysis of the merits of the plan before us. The specification refers to three musical scales, which are delineated in it, and which we do not think it necessary to give. These scales are to be let into the finger board, by dovetails. They have frets across them at each semitone, so that when the string is pressed by the finger, it is stopped by the fret, as in some guitars, a little variation of the finger not affecting the note. These scales may be changed. One of them is for pieces keyed on D major. One on the minor scale, and the other for pieces on C major.

Besides these scales, there is what is called a tuning scale, or block, which is to be slipped into the place prepared for the scales. It has projections rising on it with notches to receive the strings alternately. The object, if we understand the description, is to stop the string at such a part as shall enable the performer to tune it, by making it sound the same note with the preceding string. Thus, when the treble, or E string, is raised to the desired height, the second, or A string, is placed in the notch intended for it, and strained till it produces the same sound with the treble, and so on.

The claim is to the three main scales, and the tuning scale, or block.

---

65. For a *Thrashing Machine;* Andrew Richison, New Carlisle, Clark county, Ohio, April 22.

This thrashing machine has a cylinder and concave of the ordinary construction. As the straw passes from the concave, it is taken hold of by a revolving rake, with four arms, and teeth on cross pieces, the grain falling out underneath.

"The *invention* here claimed, is the construction and arrangement of the several parts of the machine; but particularly the mode, before described, whereby the grain is separated from the straw, and the latter thrown out by the revolving rake."

Should nothing be retained, either in general, or in particular, but what is new, the remaining part of this machine would occupy a very small space.

---

66. For an improvement in *Horse Shoes;* John Dietz, city of New York, April 22.

The shoe is to be made bevelling from the inner towards the outer edge, and is to be considerably thicker than ordinary.

"By this method of construction, the shoe is prevented from clog-

ging with ice or snow; and being of a uniform thickness, sets easier to the foot of the animal, and on account of the pressure being equal on all sides, is far more durable than the common horse shoe."

Instead of a groove for the nail heads, countersinks are made, and nails suiting them pass in flush.

---

67. For an improvement in the *Horizontal Square Piano Forte;* Ebenezer R. Curcier, Boston, Massachusetts, April 22.

The objects claimed to have been accomplished by this improvement are the following: The making each hammer strike one or more strings, as in the grand piano forte; for which purpose the hammer rail is made to shift by means of a pedal. The placing the key board exactly midway of the instrument, giving a compass of seven octaves, and preserving greater symmetry and beauty than by the ordinary arrangement. The running of the braces very near to the strings, thus attaining great strength and lightness, with the property of keeping in tune.

As these advantages depend principally upon the arrangement of the action, a drawing would be necessary to their explanation.

---

68. For the application of power to the *Extracting of Stumps of Trees;* Willard Foster, Oswego, Tioga county, New York, April 22.

A straight post of about nine feet in length, with a cross piece of timber morticed on to its lower end, to prevent it from sinking into the ground, is placed at the distance of about two feet from the stump to be raised; its upper end is to incline so as to stand over the stump. A chain, one end of which is firmly attached to the stump, passes over, and rests upon the upper end of the post first mentioned; the other end of the chain is to be fastened round another stump, or any convenient fixed object. If this chain be then shortened by any means, and all the attachments be secure, the stump will be raised. This shortening is proposed to be effected by means of a tackle attached to the chain, drawing it laterally; or by means of a long lever with chain and hooks near to one end of it, which hooks may be so attached to the main chain, that by twisting the lever it may draw forcibly upon them.

There is no claim made, but we are told that "the power may be applied to extracting stumps, raising weights, drawing up vessels, moving buildings or other ponderous bodies, and such part of the machine, or the whole, applied, as will effect the object."

As no new power, or machine, is brought into action, but means resorted to which have been heretofore applied in various ways, we presume it would have been best to have confined the description to the raising of stumps, because it is probable that such part as has been heretofore employed for other purposes, may still be freely used.

---

69. For an *Ink Holder;* Daniel Harrington, Philadelphia, Pennsylvania, April 22.

This is an ingenious contrivance for regulating the height at which the ink shall stand in the vessel containing it, and for securing certain other advantages; as this ink holder consists of several parts, tending to the attainment of the same ends, its structure cannot be fully explained without the aid of a drawing.

The ink is contained in a cylindrical chamber, in the part which may be denominated the ink stand. A second chamber is provided into which the ink is to flow from the first, there being a lateral opening from one into the other. A cylindrical cup, or box, screws into the first chamber, and may be readily made to press upon the surface of the ink below it. When depressed, the ink rises in the second chamber, and when raised, the ink in this second chamber is depressed, and it is evident that its height may be thus regulated. Another cylindrical cup screws into the second chamber, which is also capable of being raised or lowered as desired. Into this cup the pen is to be dipped. A disk of cork is placed within it, against which the end of the pen is to touch, preserving it by its texture from any injury.

---

70. For *Cast and Wrought Iron Mill Spindles, and a Cast Iron Driver;* James Barton, Milford, Pike county, Pennsylvania, April 23.

"The improvement in the cast iron mill spindle consists in casting it with a square or round hole in the bottom of the spindle, about three inches in depth, into which is to be inserted a cast iron, or wrought iron and steel foot, on which the spindle turns. The length of this point or foot is about seven inches, and it is to be so fashioned as easily to slip in and out." "The improvement in the wrought iron spindle is similar to the cast iron above described, having a hole punched in the bottom into which is to be inserted a cast iron, or wrought iron and steel point or foot that may be put in or taken out at pleasure."

Under the drivers there is to be a collar of cast iron, about five inches long, and four and a quarter in diameter. It is to be slipped on a square upon the spindle, and rests upon a shoulder prepared for it. The driver, resting upon the collar, is to be of cast iron.

---

71. For a *Machine for giving Motion or Exercise to Invalids,* in their own Rooms; Daniel Harrington, city of Philadelphia, April 23.

The general form of this instrument, or machine, may be that of a sofa, arm chair, or other kind of seat, or lounge. These may be placed upon rockers, similar to those of rocking chairs. The seat of the chair, or other vehicle, instead of being supported, and connected to the rockers by legs, are sustained upon springs; which are usually of an elliptical form, or that of a double bow; there is a series of these springs, one above the other, and properly connected by their middles. They may be hidden by drapery, and the whole apparatus

assume an elegant appearance. The number of pairs of springs may vary, but from three to five on each side will operate most agreeably.

The invention claimed is to the application of springs to a health vehicle, for the purposes described; these springs may be varied in form; grass-hopper springs, straight springs, connected in a proper manner, and others may be employed for the same purpose.

The vehicle may be moved by the invalid; or when necessary, the motion may be given by an attendant, and the force of it may be regulated according to circumstances, so as to imitate the exercises of walking, trotting, or galloping.

---

72. For a *Machine for separating Gold from Earth*, and other substances, being an improvement on the Rocker and inclined Plane; Green B. Palmer, Burke county, North Carolina, April 23.

"As to my claims of the improvement on the rocker, they are—

"1st. Forming the rocker, containing perforated iron plates in such a way, that the sand, gravel, &c. can then be thrown in at the upper end by moving the handle, or lever, from the head to the middle, or elsewhere, so as to be out of the way of the workman at the head.

"2nd. Putting into the rocker, underneath the perforated iron plates, inclined planes, with bars or stops across them, so as to detain quicksilver, and so constructed that the whole must be in constant motion, together with the earth, sand, water, quicksilver, gold, &c.

"3d. The invention of the lever and knocker in the middle, so as to strike on the springs at each vibration.

"4th. Poising the machine on pivots, points, or gudgeons, so as to support the weight.

"5th. The process of locking in, either by bars across the perforated iron plates, or as a drawer at the head.

"6th. The principle of the motion used in the inclined plane beneath the perforated plates, for fanning out."

"7th. The principle of the spring on which the jarer, or knocker, works.

"8th. The improvement of the inclined plane, or riflers, with stops across them, from the notched log, or gutter."

We have given no more than the claims to the foregoing machine. The whole specification is of considerable length, and would not be intelligible alone, or interesting to many of our readers.

---

73. For an improvement on the machine for *Splitting Leather;* Alpha Richardson, Boston, Massachusetts, April 23.

This is an improvement upon "Parker's machine." It is one of those which would require a plate for its illustration. We are told that "all the improvements are clearly and distinctly shown on the *accompanying model.*" The proper place is the *accompanying drawing*, when the law is taken as a guide.

74. For an improvement in the process of *Dressing Woollen Cloths,* and cloths composed partly of wool, and partly of cotton; Calvin W. Cook, Lowell, Middlesex county, Massachusetts, April 23.

(See specification.)

---

75. For an improvement in *Rail-road Carriages;* William Howard, Civil Engineer, Baltimore, Maryland, April 23.

(See specification at p. 391 of the last volume.)

---

76. For a machine for *Thrashing Grain and Clover,* mashing and grinding grain, and for hulling and smutting it; Orange Dean, Jr., and Joseph Woodhull, Caladonia, Livingston county, New York, April 25.

The cylinder of this machine is to be covered with plates of cast or wrought iron, having teeth upon them, resembling saw teeth. The concave is to surround the cylinder, for one-half of its circumference. The teeth of the cylinder are not to reach within three inches of its ends, and curves of wood are to be fitted to these smooth parts, sustaining the hollow segment at a due distance from the cylinder. The concave, instead of teeth, is to be furnished with vertical grooves. A vibratory motion is to be given to the cylinder; this is to be effected by means of a wheel on the shaft of the cylinder, which has on it a zigzag groove, or fillet, which serves to guide a lever connected with the concave, to which it communicates a motion of about two inches backwards and forwards, lengthwise of the cylinder. For clover seed, the teeth and grooves are to be smaller than for grain.

When used for mashing or grinding, hulling or smutting, the concave is to contain teeth instead of grooves. Sieves, screens, &c. may be added, and shaken by the zigzag.

The claim is to the principle of the lateral, or backward and forward, movement; and to the other parts which, though not new in themselves, are new in their general arrangement.

It seems to us that what is here patented can scarcely be called *a machine,* but is rather two or more machines, as when used for the different purposes designated, the same instrument will not answer the intention; but parts, if not the whole of it, have to be changed. If the same machine would apply to all the purposes designated, a patent for the machine might legitimately include its application to the whole of them.

---

77. For *Dogs for Saw Mills;* Anson Andrews, Spencer, Tioga county, New York, April 26.

The patentee says, "What I claim as my improvement is the manner of shifting the gauge dog on the square bar, and the manner in which it is made, also the screw that passes through the eye against the end of the bar, to shift the bar to the exact thickness of

the lumber; also the dog that holds the log on the other end of the tail block, through which passes an angle dog, together with the hand that is fixed on the upright part of the half bail, and the manner of lengthening and shortening it."

There is a drawing, but it is without "written references."

By turning back to our list of patents for 1830, it will be seen that four patents were granted in the course of three weeks for dogs for saw mills. One on the 19th of February, one on the 10th of April, and two on the 13th of April. That on the 10th of April was obtained by the same person to whom the above has issued. The claims in both cases are so similar, as to make it appear that some of those points now claimed were included in the patent of last year, which is altogether inadmissible, as there cannot be two valid patents for the same thing. The present, we apprehend, should have been taken for an improvement, merely, on the former patent.

---

78. For a *Thrashing Machine;* Joshua S. West, Portland, Chataque county, New York, April 26.

The "cylinder" and concave meet us, as usual, with this difference, that the *cylinder* is a *cone*, or rather, is made conical, its diameter at one end being an inch greater than at the other. Bars of iron pass from end to end of it, running spirally.

"To this machine is added a hopper, or feeder, which receives English grain in loose bunches, the heads of the grain at the largest extremity of the cylinder, and the butts of the straw at the smallest extremity. As the cylinder is tapering, and the bars of iron on it run spirally, the straw passes through quartering, in consequence of which the machine clears itself light and easy, and does not become choked as is the case with machines where the straw passes through endwise."

There is no claim made, yet certainly the whole machine is not new. The conical form of the "cylinder," we believe to be so.

---

79. For a *machine for Thrashing Grain*, shelling corn, and grinding apples; Alonzo L. Smith, Weedsport, Cayuga county, New York, April 27.

This machine, which is to fulfil three several purposes, is in fact three several machines, for which one common frame will answer, and which may be driven by the same motive power. There is a thrashing cylinder, with twisted iron bar beaters, and a concave bed. Another cylinder, set with teeth in the old fashioned way, for shelling corn, and a concave bed, with a spring, against which it is to operate. A third cylinder, and its bed, are set with teeth, for grinding apples.

In the corn shelling machine the claim is to "the shape, form, action, and, finally, all its most essential parts."

"In the grinding apples, all except the teeth, the shape of the cylinder, and its being propelled by horse power."

"In the grain thrashing part, all except the use of square bars in the bed, shape of the cylinder, and manner of propelling. And, further, the great advantage of *one* machine answering three purposes." There is certainly some mystery in forming one machine of three.

---

80. For a *Thrashing Machine;* Edmund Warren, city of New York, April 27.

The cylinder is to be banded with iron from end to end, and is to have teeth; the concave is to be like other concaves; the frame supporting the cylinder is in the form of an equilateral triangle, resting on one of its sides; the claim is to "the wrought iron hooped cylinder with spurs; the particular form of the frame, to give great strength with little expense or workmanship; as also the inclined springs for the concave, with the mode of changing them by screws, for corn."

---

81. For a *Saw Trimmer;* John R. Failing and Robert G. Nellis, Canajoharie, Montgomery county, New York, April 27.

This is a machine for what is sometimes called gumming saws. It is merely a steel punch, sliding in a socket, with a bed below it, upon which the saw is to be laid. When used it is to be placed upon an anvil, or other solid body.

Which of our mechanists will point out the novelty of this invention? The saw maker certainly will not.

The claim is to the exclusive privilege of using this machine.

---

82. For a machine for cutting or *shaving Smoked Beef or Cold Slaw;* Henry Bangs, city of New York, April 27.

The old cutting knife and board, for cutting cold slaw, is to be fixed so that the edges of the board may slide up and down between two vertical posts. There is to be a piece of timber on which to rest the beef, or cabbage, and a box below to catch the cuttings. The claim is to the foregoing machine.

---

83. For a machine for *Dubbing, or Dressing, of Ship Timber*, knees, plank, &c.; John Judge, Navy Yard, Washington, District of Columbia, April 27.

The timber to be dressed is to be fastened on to a carriage by suitable screws. The carriage may be made to advance by means of a rack and pinion, like a saw mill carriage. A wheel, or wheels, with cutters, is made to revolve, by the application of any sufficient motive power. There may be two cutter wheels on the same shaft, one operating upon each side of the timber which is embraced between them. These may be adapted to any thickness of stuff by making them advance towards, or recede from, each other, by means of a screw on the shaft, or a groove and key, in ways well known to workmen.

The claim is to "the application of cutters on the periphery of wheels, to the hewing, dubbing, or dressing of ship timber, plank,

knees, &c. &c., with the manner of fastening the timber to the carriages; and also the manner of adjusting the wheels to the different thicknesses of timber."

This is a machine well calculated to facilitate labour in the way designated; and to effect its purpose with much greater truth than is possible by hand. The patentee is a skilful workman at the Navy Yard in this city, who has introduced several valuable machines, and modes of procedure at that establishment, by which the public have been much benefitted; but, we believe, without that recompense to which his real merit justly entitles him, and which he probably would have obtained had he been out of the service.

---

84. For a self acting fulcrum, screw, or spiral lever, for *propelling Vessels, and Rail-road Carts*, &c. &c.; John James Giraud, city of Baltimore, Maryland, April 27.

(See specification.)

---

85. For a machine for *Gumming Saws;* Phineas Newton, Sidney, Delaware county, New York, April 29.

This machine consists of a lever with a long and short arm, the short arm forcing down a steel cutter upon a steel bed, the latter having an excavation adapted to the tooth, and the end of the cutter fitting into this excavation. There is no claim, nor any thing novel in its mode of operation. Besides the patent above noticed, for the same purpose we have previously recorded three or four others, all of them operated upon by levers. Why does not some one patent the application of the screw to gumming saws?

---

86. For a method of *Amalgamating and Washing Residuums, or the Gold and Silver Ore*, pulverized, or calcined, in their first state, to extract the gold or silver; James Lewis Montaudevert, Charlotte, Mechlenburg county, North Carolina, April 30.

The residuum of ore that has been ground, and, if necessary, calcined, is to have the metal which may have escaped the first amalgamation extracted by the process described.

The residuum after having been dried, is to be moistened with a portion of common salt, put into a wooden trough with quicksilver, and pounded. About ten per cent. of quicksilver will be required. The mass in the trough should not exceed four inches in depth.

To collect and unite the quicksilver, an iron or copper washer, like a soap boiler's kettle, is to be used. It must be of ten times the capacity of the residuum. This washer is to be placed over a furnace, a large surface being exposed to the action of the fire. It is to be nearly filled with water, which is to boil for thirty minutes. The quicksilver will be found in globules at the bottom, after the fire has been removed. The finer particles, which sometimes float, are to be beaten down by a shower of cold water, or by a spatula.

The fluid is to be drawn off into successive receivers, furnished with spouts like those of tea kettles, delivering it from one to the other. In these successive receivers the floating quicksilver is to settle; and the quicksilver collected from the washer, and the successive vessels, is to be used with other residuums, until it is sufficiently saturated with the gold or silver.

It is said that this process is more economical than those heretofore employed: that little or no quicksilver is lost, and residuums which would not bear an expensive process can consequently be used.

The washing with boiling water; the precipitation by a shower bath of cold water; the collecting the floating particles in successive receivers; the repeatedly using the same quicksilver until sufficiently saturated, and the application of the same process of washing, constitute the claims.

---

87. For an improvement upon a *Water Wheel for propelling Boats*, for which a patent was obtained on the 22nd day of December, 1818; Asa Waters, Millbury, Worcester county, Massachusetts, April 30.

The buckets are made to swivel upon pins on their ends, working in arms. There are cams for locking and unlocking them, the intention being that the buckets may "always strike the water at a proper angle for obtaining most power, and have no back water to raise; because, when the buckets are brought to a certain position or bearing in the water, the cams at the bottom of the wheel press on the levers and unlock the floats, and let them swing loose on their pivots; and at the same time the floats at the top are locked by the same means; thus producing a maximum of power in the wheel."

We have not heard that the wheel, as first patented, has been brought into successful operation; nor do we anticipate that with the improvements it will make its way as well as the common paddle wheel. We expect but little from swinging buckets in general.

---

88. For a *Thrashing Machine*, called the "twin cylinder and double concave thrashing machine;" William E. Osborn, Brighton, Monroe county, New York, April 30.

There are, as the name indicates, to be two cylinders and two concaves. The cylinders run close together, a line joining their axes forming an angle with the horizon, of about 45 degrees. The teeth in the cylinder, and the bars forming the beaters, are similar to some formerly patented, although they are here claimed as new. The two, or more cylinders, and concaves, are also claimed.

---

89. For a machine for *Grinding, Levelling, and Polishing Plates of Metal*, and other hard substances; William J. Stone, city of Washington, District of Columbia, April 30.

(See specification.)

LIST OF AMERICAN PATENTS WHICH ISSUED IN MAY, 1831.

With Remarks and Exemplifications, by the Editor.

1. For improvements on a machine formerly patented by Amos Whittemore, for *Cutting the Teeth, Pricking the Holes, and Setting the Teeth in Filleting Cards;* Reuben Meriam, Leicester, Worcester county, Massachusetts, May 2.

"The improvement consists in effecting the side motion of the carriage which holds the leather, in a more gentle and perfect manner, so that the operation may be greatly accelerated, and the machine at the same time be less liable to get out of order."

How this is to be accomplished we shall not attempt to describe, the complexity of the machine rendering any such attempt useless, excepting to those few who are perfectly acquainted with the structure of this ingenious instrument, as at present made.

---

2. For an improvement in *Distilling;* James L. Jenks, Sackett's Harbour, Jefferson county, New York, May 2.

(See specification, p. 321, of our last volume.)

---

3. For an *Apparatus to be connected with, and to form part of, a Steam Engine Boiler;* Philo C. Curtis, Utica, Oneida county, New York, May 3.

(See specification.)

---

4. For a machine for *Cutting Grass and Grain;* William Manning, Plainfield, Essex county, New Jersey, May 3.

(See specification.)

---

5. For an improvement in *Stoves to be heated by Stone Coal;* Urban B. A. Lange, city of Philadelphia, May 3.

The grate in which the coal is to be burnt, is not within the stove, but is connected to it by a horizontal flue leading into the lower part of it. The stove consists of several compartments, all of which are to be heated by the flue through which the heated air is to pass, such a direction being given to it as is adapted to the purpose.

The particular arrangement adopted is represented in the drawing. The claim is to "the construction of said stove, and the application of stone coal to heat the same."

---

6. For a *Machine for Grinding Bark;* Merrit Hurd, Augusta, Oneida county, New York, May 5.

This bark mill is not very distinctly described, but the patentee appears to consider it as new in nearly all its parts: he says, "I claim as my own invention all parts of the said machine except the teeth in the hoops;" these hoops we will presently describe. As re-

presented in the drawing, most parts of this machine appear to resemble such as are well known, and have been long used.

The shaft stands vertically, in the usual manner, and carries a conical nut, furnished with teeth, for breaking the bark, which is contained within the surrounding rim. Below the conical part of the nut, it assumes a cylindrical form, and is furnished with teeth, as usual: this is the part called the hoop; it is to be made of cast iron, in segments, screwed on, and capable of being renewed, as the teeth wear out. This construction of the hoops is claimed as new.

---

7. For an improvement in the *Apparatus and Mode of Drawing Soda Water;* Justus Perkins, Brutus, Cayuga county, New York, May 3.

A vessel of tin or other material is to be made, and divided into two parts by a partition across. A cock is to be inserted into this vessel, the tube of which, behind the key, is to be divided into two parts by a partition corresponding with that of the vessel; one of the parts opening into one division, and the other into the opposite. When the key of the cock is turned, the fluid flows from each division, and the two portions unite in the common orifice of the cock.

The two parts are "the one to hold the soda, the other the tartaric acid," about which two articles nothing had been previously said; it would appear, therefore, that the patentee supposes that what is usually called soda water, is prepared from these two ingredients, whilst the fact is that neither of them, ordinarily, enters into its composition; the so called soda water, being merely water impregnated with carbonic acid. The liquid in question is one form of the well known effervescing mixture of the physician; citric acid, however, being most commonly used for this purpose. The liquid is in fact a solution of Tartrate of soda. The claim is to the apparatus employed.

"What I claim is the before described apparatus for, and mode of drawing soda water, by means of a compound cock or fasset."

---

8. For an "*improved Plantation Mill*" for grinding of Grain; John Anderson, Louisville, Jefferson county, Kentucky, May 3.

This patent is taken for making the husk, and the frame work, generally, of cast iron. "The inventor claims as new the application of this material (cast iron) in its various forms to this purpose, believing it to be exclusively his suggestion; and as better adapted to this purpose than any material hitherto used," &c.

Cast iron will undoubtedly make a solid frame work and foundation for such a mill; but whether the mere use of this material will prove to be as secure a foundation for a patent, may admit of doubt.

---

9. For *making Mould Candles* by means of a machine for supplying and cutting the wicks, and drawing the candles from the moulds; which he calls "The Candle Drawer, and Endless Wick Nipper; Thomas Hewitt, jr. city of Philadelphia, Pennsylvania, May 4.

The moulds are to be fixed in a mould bench in the usual way, with their smaller ends downwards. The mould bench is placed between two uprights, forming a part of the machine. The moulds must be securely fixed, as the candles are to be drawn without removing them. Below the moulds there are spools or balls of yarn, formed of wick of the size desired; one of these is to be drawn through each mould, and passed out above it; the wicks are all confined to strips, called nippers, which extend from post to post, the whole length of the mould bench. These nippers hold the wicks exactly over the centres of the moulds, and stand at a sufficient height above the tops of the moulds to allow of the pouring of the tallow. The ends of the nippers rest upon racks which rise vertically within the posts, and after the tallow has been poured and has set, a crank is turned, which, operating upon pinions, raises the racks, and draws the candles from the moulds. As this is done, the wick is at the same time drawn into each mould, ready for a new set of candles. A sufficient length of wick is allowed above the moulds to attach other nippers, after which the wicks are cut off above these last nippers, the candles first drawn removed out of the way, the racks lowered, and the whole operation repeated.

Some modifications of this apparatus are described, and a claim is made to the machinery in general.

---

10. For an improvement in the *Making of Boots and Shoes;* Caleb A. Ore, city of Philadelphia, Pennsylvania, May 5.

"What I claim as my own invention, or discovery, is in the uppers, to wit, in making boots with one seam, and shoes without any seam."

For boots, the leather is to be strained into proper form on a crimping board, so as to require a back seam only. For shoes, the leather is to be cut for a whole upper, a hole being made for the instep. This leather is then to be wetted, and rubbed, and crimped upon a last. Slippers, shoes, and Jeffersons, are to be made in this way.

---

11. For an improvement in the *Piano Forte Action;* John F. Nunns, city of New York, May 5.

"The new principle claimed is the action of a lever in front of the hammer butt, instead of behind it, as in the ordinary method of construction: by this method a single key may be withdrawn, without deranging the rest of the action. The hammer is constructed similar to the ordinary plan, with its shaft attached to the butt, which is secured and moveable by means of a hinge or pivot to the rail."

The drawing represents the action as applied to the horizontal grand or plain instruments, exhibiting the whole arrangement in a very perfect manner.

---

12. For an improvement in *Medicine;* Joseph Baker, Jefferson, Ross county, Ohio, May 5.

(See specification.)

13. For a *Butter Churn;* Joseph Crail, Warren, Trumbull county, Ohio, May 5.

A vertical shaft is to have slats or dashers extending from it; the shaft is to run in a pivot on the bottom of the churn, and to be supported at top by a collar. The shaft is to receive a whirling motion by means of a bow and cord, exactly in the manner of the small table churns in very general use in France, and not unknown with us. The patentee says: "What I claim as particularly new, and of my own invention, is the manner of moving the shaft or dasher by a bow and strap."

It unfortunately happens that this particular novelty, as we have above indicated, is very old, although to the patentee it may appear quite otherwise.

---

14. For an improvement in the mode of *Commencing the Generation of Gas*, in the Self Generating Gas Lamp, patented on the 15th of April last, by means of a Spirit Lamp filled with alcohol, or other highly inflammable fluid; Solomon Andrews, M. D., Perth Amboy, New Jersey, May 5.

(See specification.)

---

15. *For applying Animal Power to sundry Mechanical Purposes;* William E. Arnold, Chatham, Middlesex county, Connecticut, May 7.

The power of animals is to be applied by allowing them to walk upon a moveable inclined plane, sustained by rollers, in a way well known. Three or four different modes of constructing the moveable floor are described, but not very clearly; it is calculated by the patentee, however, that his improvements will greatly increase the power derived from the weight of the animal; from what cause it is likely to produce this effect, we have not been able to ascertain.

---

16. For a *Thrashing Machine;* Samuel Fahrney, near Boonsborough, Washington county, Maryland, May 9.

The beaters and bed, or hollow segment, the feeding table, and in fact all the operating parts of this machine, have their counterparts in numerous others; the *invention* of the patentee consists in the mode in which the cast iron beaters are fastened to the heads upon the revolving shaft.

"What I claim as my peculiar invention is the form and arrangement of the bars of the beaters; and the mode in which they are placed and secured on the square block of wood by dovetailing, or locking; and the form of the revolving beater, or square block of beaters."

Like many others, the present patentee appears to have paid the fee, for the privilege of marking "PATENT" upon his machine, which may induce the unwary to suppose that it must be both new and good; the latter it may be, the former admits of doubt.

17. For machinery for *Blowing Wind for the use of Forges, Furnaces*, &c.; Daniel Strobel, jr. city of New York, May 9.
(See specification.)

18. For *Concentrating Sirop, or Cane Juice*, &c. by steam; Daniel Strobel, jr. city of New York, May 9.
(See specification.)

19. For a Composition for the *making of Beer;* Stephen Hinds, Montrose, Susquehanna county, Pennsylvania, May 11.
(See specification.)

20. For a *Mill for Grinding Grain;* John P. Phillips, Doe Run, Chester county, Pennsylvania, and John Holliday, Wilmington, Newcastle county, Delaware, May 12.

In this mill, which is of the small, or portable kind, there are three stones standing horizontally, the middle of the three being the runner, whilst the lower and upper stones are at rest. The patentees say:

"What we claim as our invention is the arrangement of the different parts of the before described mill; the use of a middle stone turning horizontally, faced on both sides, by which different kinds of grain can be ground at the same time, yet keeping the meal separate. Also the manner of hanging the upper stone; the mode of conveying the grain to be ground to the two faces of the middle stone; and the mode of tempering the stones, particularly the upper stone. We do not claim the invention of having three stones, but merely the arrangement of them as above described."

21. For Machinery for *lifting Ships out of Water*, for inspection and repair; Thomas Evans, machinist, and John Parsons, ship carpenter, city of New York, May 13.

This apparatus is intended to lift ships vertically out of the water, in the manner of the screw docks; but the power applied is that of the hydrostatic press. Its mode of application, however, differs essentially from that of Thos. Evans, described at p. 160, vol. 6.

Two cylinders, furnished with pistons, are placed horizontally, one at each side of the dock, at the land end. A steam engine is employed to force water into the cylinders, to depress the pistons. To the piston rods, timbers, forming a sliding frame, are attached, which extend along the sides of the dock, and from these timbers chains pass over pullies, and act upon other timbers crossing the dock, and over which the vessel is to be floated, as in the screw docks. There is an ingenious but simple contrivance for letting the vessel down, after her repairs have been completed; this we shall not at present attempt to describe, as it is our design hereafter to give an abstract of the specification, accompanied by engravings.

From some remarks in the specification, it would appear that the operation of this apparatus has been tested; we, however, are not informed to what extent. The principal objection which presents itself

to us, from examining the plan upon paper only, is, that it will be difficult, if not impossible, to give to it the strength of the screw dock, so as by its aid to raise vessels of a large class.*

Specifications of American Patents.

Specification of a patent for an improvement in the process of Dressing Woollen Cloths, and Cloths composed partly of Wool and partly of Cotton. Granted to Calvin W. Cook, *Lowell, Middlesex county, Massachusetts, April* 23, 1831.

The description of this process is as follows: Take broad cloths, sattinetts, or any like cloths to be subjected to the process, after they have been fulled and rinsed clean, but before the pile or nap has been raised upon them, and wind them upon wooden rollers, or cylinders, as tight as can be done without tearing the cloth. Confine them with a twine tied around so that the cloth cannot unwind, and so that the whole may remain firm and tight upon the roller, or cylinder; then prepare a kettle, or cauldron, of sufficient dimensions to receive the roller, or cylinder, with the cloth upon it. Fill the kettle, or cauldron, after having put the roller, or cylinder, with the cloth upon it, therein, with water, and apply heat thereto, until the heat rises from one hundred and eighty to two hundred degrees of Fahrenheit's thermometer, for all cloths excepting whites and blues; and for the last mentioned colours the heat may be raised to two hundred and twelve degrees, or to boiling heat. The other colours will not endure so great a degree of heat; the degree of heat can best be decided upon by experience from time to time, owing to the various ways of producing the different colours, in the different parts of the country. The degree of heat above mentioned, it is believed, will in general best answer the purpose without injury to the cloth. The water should be kept at the degrees of heat above mentioned, for the space of six hours; after which the cloth should be taken from the water and suffered to cool upon the roller, or cylinder, which will usually take about twenty-four hours.

Instead of water, steam may be applied at the same temperatures, for the same length of time, and will answer the same purpose; but in this case the cloth must be wound around a revolving roller, or cylinder, which must be kept continually in motion during the process, and the steam must be confined by a wooden box, made very tight, so as to include the rollers, or cylinders, with the cloth upon them, within it. The cloth is to be taken out and cooled in the same way as when heated by water. The operations above mentioned render the cloth very firm in the bottom, divest it of wrinkles and cockles, or drawn places, and render it even and smooth on the sur-

* Some weeks will probably elapse between the date of this patent and that which will be next issued, as, in consequence of the absence of the Attorney General, the signature of that officer cannot be obtained, and without this a patent would not be valid.

face, so that the teazles, or points, may act uniformly upon the cloth, and the fibre of the wool, or cloth, is thus rendered more pliable, and is more easily turned and laid straight and smooth in the process of teasing, or raising the pile, or nap, thereon. And I, the said Cook, do hereby expressly declare, that all that I claim as new, and of my invention, or discovery, is the subjecting the cloth to the process aforesaid, in the manner aforesaid, and for the purposes aforesaid, after the same has been fulled, and before the pile, or nap, has been raised thereon by the process of teasing.

CALVIN W. COOK.

Specification of a patent for a Screw or Spiral Lever, for the propelling of Vessels, for a new mode of Navigation. Granted to JOHN JAMES GIRAUD, *M. D., city of Baltimore, Maryland, April 27,* 1831.

INSIDE of a paddle water wheel, or frame, having a round hole in the centre, I place upon two sides, a screw, or spiral lever, three-fourths, more or less, the diameter of the said paddle wheel; this screw, or lever, to be two or more turns of the spiral: this screw lever will be attached to two self acting fulcrum levers in the following manner.

The ends of the levers, where are placed the fulcrum, are fixed, the one opposite to the other by their fulcrum, upon the edge inside of the paddle wheel, the one below, the other above, and distant a few inches from a straight line; the two other ends of the lever are fixed to a square piece of a few inches, with a round hole in the centre, placed in the middle of the paddle wheel; the end of the centre of the screw or spiral lever, is fixed on the side of the end of the lever, which is fixed on the side of the square piece, and the other end, which is made the end of the screw or spiral lever, is fixed upon the other lever, and near the fulcrum.

I place upon the screw or spiral lever, a solid round wheel, twice the diameter of the paddle wheel, with a round hole in the centre, and fixed in the middle upon the square piece above mentioned. This solid wheel has two bars, one opposite the other, which project from its edges, coming level with the edge of the paddle wheel, one below, the other above, without touching it, a little distant from a direct line; place upon the ends of the bars a self acting fulcrum lever, by their fulcrum; the other ends of the lever to pass a little over the hole in the centre of the solid wheel:—a square piece of a few inches, having a square hole in the centre, will be placed between the two ends of the levers, to touch, yet leaving it free. A smaller screw or spiral lever will be placed and fixed to the ends upon the side of the end of the lever, which touches the square piece; and the other end of the screw to be fixed upon the other lever near to the edge of the solid wheel; the same thing to be done upon the other side of the paddle wheel. The shaft of the paddle wheel is square

in the middle, and round at each end: the shaft is placed in the holes of the two square pieces, and the power is conveyed there.

I claim the principle of my invention and improvement in every species of levers, and of every form, and figure, and application, as above described. J. J. GIRAUD.

Dr. John James Giraud's Self-acting Fulcrum Screw or Spiral Lever, for propelling Vessels and Rail-road Carts, &c. &c.

Fig. 1.

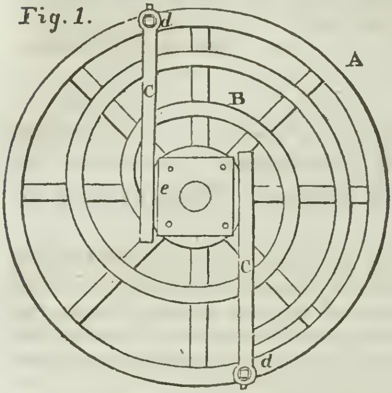


Fig. 2.

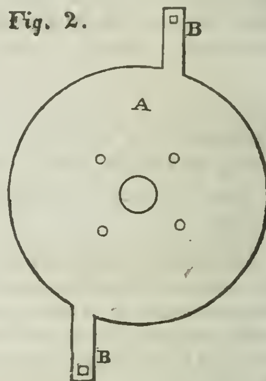


Fig. 3.

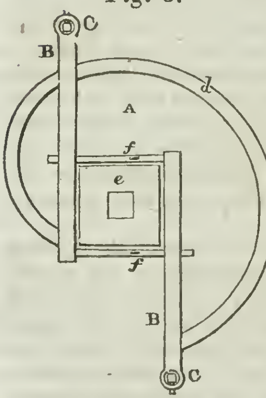


Fig. 1.—A. The inside of one side, or part of the water paddle wheel.

B. Screw, or spiral lever.

c, c. Self-acting fulcrum levers.

d, d. The fulcrum.

e. The square piece with round holes.

Fig. 2.—A. Solid wheel with round hole in the centre.

B, B. Projecting bars with square holes.

Fig. 3.—B, B. Self-acting fulcrum levers.

c, c. The fulcrums.

d. The screw, or spiral lever.

e. The square piece with square hole.

f, f. The moving bars.

☞ Fig. 2 is to be placed upon Fig. 1, and Fig. 3 upon Fig. 2.

Remarks by the Editor.—We have noticed several patents obtained by Dr. Giraud, and have attempted an analysis of them in our monthly list; from the recondite nature of his discoveries we have always risen from our task with a conviction that the attempt has been a failure; and such would have been the case in the present instance. To save ourselves from this mortification, we have deter-

mined to publish the specification entire, with the drawings intended to illustrate it.

"A new mode of navigation," if it be an improved one, is an invention of no mean importance, and should any of our scientific readers be more fortunate than we are, in keeping up with the patentee in the elucidation of his mode of "propelling vessels, and rail-road carts," &c. &c., we ask of them to supply us with a commentary upon the subject.

Since the foregoing was written, we have seen, in the Baltimore papers, an attempt to explain the operation, and to convince the public of the great value of this machinery. The style of the explanation accords so well with that of the specification, as to fix upon them the character of a common origin. So far as we are concerned, however, the explanation has not served to explain, what the specification failed to specify. They are both transcendental.

Specification of a patent for a Machine for Grinding, Levelling, and Polishing Metallic Plates, to prepare them for the Engraver, and for other purposes. Granted to J. W. STONE, *Washington city, D. C. April* 30, 1831.

To all whom it may concern, be it known that I, J. W. Stone, have invented a new and useful machine for the purpose of grinding, levelling, and polishing plates of copper, steel, iron, brass, or other metals, so as to prepare the same for the use of the engraver, or for other purposes, and to grind, polish, and level metallic or other hard substances, such as marbles, stones, slates, or any substance that require to be ground and polished, and that the following is a full and exact description of the manner in which I effect the same.

When metallic plates are to be ground, levelled, or polished, they are first hammered, or planished, in the usual manner, or made flat in any other way; they are then placed on a flat horizontal bed, which may be made of any suitable material, and sufficiently large to secure the largest piece to which the machine is adapted; the plates are secured to the bed by ledges, stops, or in any other convenient manner. The bed upon which the plate is fixed, is carried backwards and forwards, under the stones, grinders, buffs, or brushes, by which the plate is to be ground, levelled, or polished. The diameter as well as the width of these stones, buffs, polishers, or brushes, may vary according to the power applied to the machine, or the nature of the article operated upon. To give the traversing motion to the bed, a part of the general frame work of the machine forms a rail or carriage way of double the length of the bed. An iron screw, or rack, is placed under the bottom of the bed, and lengthwise of the machine; this iron screw, or rack, is operated upon by means of gearing from the crank or part to which the power used is applied, and for the purpose of giving motion to the other parts of the machinery. When a screw is made use of to move the bed on the carriage, a thread is cut through the centre of a wheel, which wheel is attached to the rail or carriage way on which the bed slides. This wheel is held firmly

on its own axis, thereby preventing its moving in a line with the screw, whilst at the same time it turns freely, and when motion is given to it, the screw is forced along, either backwards or forwards, to the distance required. I intend sometimes to attach a toothed wheel to the head of the screw, in order to cause it to revolve; the screw, in this case, will be made to work in a fixed nut, when the same effect will be produced as in the former arrangement. When, instead of the screw, a rack is used, it is fixed to the bed, and a pinion is made to operate on it in the usual way. The shaft to which the power is first applied may be made to revolve in one direction only, and yet carry the bed and plate backwards and forwards, by the addition of gearing, made to engage and disengage, in a way well known to machinists. This gearing, however, may be conveniently dispensed with, especially when the machine is worked by hand, as the crank may be turned either way. The grinding, levelling, or polishing, is effected by revolving stones, grinders, buffs, or brushes; these are fixed on proper spindles with whirls on them to receive a band from the main shaft. The spindle is fixed in a frame in such a way that the grinders or buffs may operate upon the plate. This frame extends back to one end of the machine, where it works upon a pivot, or bolt, which allows it to receive a lateral vibratory motion; such a motion being essential to the proper action of the grinders, buffs, &c. This motion may be effected by placing two eccentric wheels reversed on the shaft to which the power is first applied; one operating on each end of the frame that receives the grinders, buffs, &c. thereby causing the frame to move on the bolt, and consequently give a lateral vibratory motion to the grinders, buffs, stones, polishers, or brushes; or this motion may be effected in various other ways.

The bed that carries the material to be ground, levelled, or polished, and the buffs, polishers, brushes, or stones, as well as the parts which give the vibratory motion, are geared and connected in such a way as to move at one uniform and fixed velocity, otherwise the surface to be ground or polished would be acted upon unequally.

The frame carrying the grinder, &c. I force down by a spring, or weight, or otherwise, according to the force with which I wish them to bear on the material to be ground, making an arrangement to increase or remove the same at pleasure. The lateral vibratory motion of the grinder, polisher, &c. may be increased or decreased in such a manner as may best suit the size or nature of the material to be ground or polished.

The grinders may be made either of wood, iron, steel, copper, lead, stone, or other material, and their action promoted by applying any gritty substance pulverized, either dry or with oil, or water, as the case may require. The grinder, to operate well, should be of a softer material than the article to be ground or polished.

What I claim as my invention is the grinding, levelling, or polishing plates of copper, or other metals, or slabs of marble, stone, slate, glass, or any other material, by placing them upon a traversing bed, and operating upon them by means of revolving stones, grinders, buffs, and brushes, which revolving stones, &c. are fixed in a

frame to which a lateral vibratory motion is given; this lateral vibratory motion forming an essential part of my invention.

J. W. STONE.

Specification of a patent for an Apparatus to be connected with, and to form part of, a Steam Engine Boiler. Granted to PHILO C. CURTIS, *Utica, Ontario county, New York, May* 3, 1831.

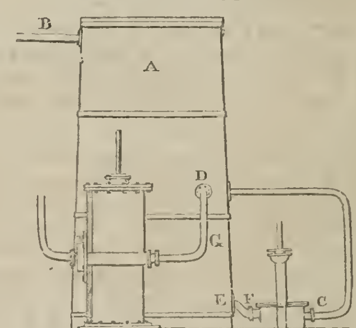
MAKE a tub of about four feet in height, and two feet and four inches in diameter at the top, and two feet eight inches at the bottom. This is a suitable size for a high pressure ten horse power engine. This tub should have two heads, one at each end, and a partition about eighteen inches from the bottom of the tub. In the drawing annexed, the vessel marked A, exhibits the form of the tub. Within the tub, and between the upper end thereof and the said partition, place a strong tube with a calibre of about one and a fourth inches in diameter, and about sixty feet long, coiled similar to a common condensing worm for a distillery. One end of the tube passes through the upper part of the tub, and is firmly connected with the boiler; this part of the tube is marked B. The other end passes through the lower part of the tub above said partition, and is firmly connected with the forcing pump of the engine, as at the letter C on the drawing. The upper part of the tub should be tight, except an inlet, C, for the steam from the piston cylinder; and an outlet for the said steam through a tube firmly connected with the said partition, and from thence extending downwards towards the bottom of said tub; and through which tube the steam is conducted into the lower part of said tub, and below the surface of the water therein; as said lower part should be kept about half full of water. This water may be supplied either from a fountain, or by the operation of the engine, to serve for feeding water for the boiler. A tube of the calibre of the one first above mentioned, should be placed between the tub and the forcing pump, one end of which said tube should be firmly connected with a hole in the side of said tub, and near to the lower end thereof, so as to receive the water from the said lower part of the said tub; and the other end of said tube should be firmly connected with the forcing pump. Letter E on the drawing shows the point of connexion between the tube and the tub; and letter F shows the point of connexion between said tube and the forcing pump. When the engine is in operation, the forcing pump draws water from the lower part of the tub into the tube at E, thence it passes through the pump into a tube at C; thence through that tube as it is continued and coiled, through the upper part of said tub, and so on until it is discharged into the boiler through B. The steam from the piston cylinder is conducted from it through a tube and discharged into the upper part of the tub at the letter D; the steam so discharged fills the said upper part, and heats the water as it passes from the forcing pump through the tube into the boiler, as before described. From this upper part of the tub the steam passes into the lower part of

said tub, through the tube of which mention has been before made; and from this part of the tub that part of the steam which remains uncondensed, passes off through another tube; which tube should be connected with the tub below the partition, and above the water in said lower part.

The objects to be effected by the improvement and apparatus above described are, 1st. A reduction in the consumption of fuel for the boiler. This is done by giving to the water which is conveyed into said boiler, a very high temperature, on its passage through the coiled tube in the upper part of the tub. 2nd. This mode of supplying heat for the water in the boiler, is more regular than it could be if furnished by fuel alone; hence less attention to the furnace is required, and the generation and supply of steam from the boiler are more regular than in the ordinary mode. The object of the coiled tube is to form a surface of sufficient size, which being exposed to the steam in the upper part of the tub, will allow the water in passing through said tube, time to acquire, very nearly, the temperature of the steam in the tub, and which, as the water is confined in the tube so that it cannot change into steam, is practicable. The water is thus raised in temperature much above boiling heat, and in that state passes into the boiler. The above described form I think the best calculated to produce the desired effects. The size of the apparatus must be varied in proportion to the capacity of the engine.

The combination of the above apparatus, and the application thereof to effect the objects above specified, are what I claim to have discovered and invented. PHILO C. CURTIS.

Curtis' Steam Apparatus.



Specification of a patent for an improvement in Medicine. Granted to JOSEPH BAKER, *Jefferson, Ross county, Ohio, May* 5, 1831.

A MODE of *prepareing*, mixing, compounding, *administering* and *useing* the medicine herein described in the *muner*, and in the diseases hereinafter mentioned: that is the mode of *prepareing* and compounding medicine for an emetic and *al so* to *cous* a free *per spiration*

to be administered in diseases *coused* by cold and *ob structed* perspiration, such as *fevurs rumatism, dysentery* dropsy *consumtion pleuricys* Boldhives and all stagnated complaints with some others

N. B. All *Root* and Barks and Herbs must be first dried pounded in a *morter* or ground in a mill before *thay* are made *in to* medicine

Part the first.—Take *Sinaca* snake root one ounce Take Liver wort tops three quarters of an ounce Take *plantin* roots and tops one quarter of an ounce mix these well *to gether* this *formes* the first part of the *compasition*

Part the Second.—Take the Bark of the root of *sasafras* a half ounce—Take the *in side* Bark of wild *Chery* a half ounce.—Take the *in side* Bark of Elder a half ounce—Take *Sulfer* or *Brim stone pulferised* a half ounce mix these well *togethur*—this *formes the se cond* part of the *compasition*

3d part.—Take *Lobela* or what may be known by the name of indian *tobaco* the tops gathered in september two ounces

This *formes* the third part of the *compasition* which is to be administered *all togethur* or in parts as the nature of the case may require—It should Be remembered that *Equel* portions of these three parts *formes* the whole *compsition* of medicine,—It should be remembered that a dose of *Ither* of these powders for an ordinary *constatution* is on average tea spoon full and *a lowance* should be made for the *diferent constituons* of people

When the violence the *diseas requiers* a *speady remady* and Nature calls for an emetic and there is an *ob structed* perspiration it is *nesasary* in this case to give a dose of powders of the whole *compasition* and wash them down with a half a *point* of cold weak lie made of the bark of shell bark *hickary,* and if this dose do not operate as an emetic in 15 Minutes give a second dose with a less *quantaty* of lie or *jist a nough* to wash it down and if it doth not operate in the same time you may try the third and *fouarth* on the same rule which will *scarly* fail this process commonly produces a free perspiration then continue the process by *giveing* a dose of powders of the first part of the *compasition* and in thirty minutes sweat until you get a free sweat over the body the way to sweat is to cover the person all over and make *youse* of two over lids one at a time have their feet in warm water and *sit* your over lid under the cover and form a mixture of one third *whisky* and two thirds water of *a bout* three gills and steam it on the over lid as *thay* can bear it and repeatedly *sup* warm tea and when done put them to bed cover *thir* breath a short time with a hot stone *squinched* and *wraped* up in a wet cloth at *thir* feet *thir* teas should be spice bush or red *peper* during sickness make a drink of water by *squinching* a hot *cole* in it *tell* the chill is *of*

Take two doses of the *fiers* part of the *compasition* in the course of 24 hours and one of the second part *divideing* the time of *takeing* them—and sweat once a day for three days and if the person have fever and ague *sweet* once a day *untill* it *leaves* them and keep up a moist sweat as steady as *posable* during the whole time and keep them warm in the chill and fever—*there* diet should be light such as chicken or squirrel broths with a little of the meat and as little bread as *posable thay* can make *youse* of rice or *homany* But keep the *stomack*

as empty as *conveenyant* and *espesually* for three days and *aftur* that *thay* can *in creas thir* diet *gradualy unticl* well

If the *diseas* is less violent you may leave out the first part of this process and begin by *giveing* a dose of the first part of the *compasition* and then sweat and so follow the rule as is laid down *a bove* and if it is found that the first part of this process is *ne sa sary* it can be *aplyed* at any other time

In *pluraeys* and bold hives and many other complaints it is only *nesasary* to *persue* the rule *untill* the *patiant* recovers which is not likely to be long

Let it be well remembered that nature is the Grand *Phesition* and *wee* are only to assist her in *removeing* the *ob structtions* that *is* found in her way as far as is in our power and that *whe* should pay *petickler atention* to her *clames* and try to supply her wants if *posable*

In cases of less violence these powders may be taken without a preparatory sweat either in whole or in separate parts as the cases may require JOSEPH BAKER.

Remarks by the Editor.—It has been with some difficulty that we have done justice to the new orthography employed in making known the foregoing new and improved mode of curing diseases; as, however, it would have been the height of injustice to its author to have added, or abstracted, a jot or tittle from his elegant memoir, we have cheerfully undertaken the labour of following him through all his labyrinths. We are truly glad that we are not called upon to write a commentary upon the system, and still more so that we are not compelled to have its efficacy tested by becoming the *patiant* of this great *Phesition.*

Abstract of the specification of a patent for a method of Generating Gas, and of supplying and continuing Gas Light, out of oil, or other suitable substance, by means of the gas light itself, in lamps, or machines, either fixed or moveable. Granted to SOLOMON ANDREWS, *M. D. city of Perth Amboy, Middlesex county, New Jersey, April* 15, 1831.

THIS invention consists in having the gas lamp so constructed that the heat of the inflamed gas, or gas light itself, operating upon the oil or other substance used for the purpose, shall continue to form gas therefrom to supply or feed the gas light. In the accompanying drawing the letters *a*, *a*, represent a part of the supply tube through which the oil or other material enters, of which the gas is made; *b*, the upper end of the supply tube emptying into the bulb; *c*, the bulb, represented in the form of an inverted cone, which may be filled with fine wire, to communicate heat the more readily throughout the contained fluid, the gas being generated in this bulb: *d*, a turret erected to cover the gas tube, *e*, which is best elongated so as to extend above the bulb, to prevent any particles of oil or other substance from entering the gas tube. *f*, the entrance into the gas

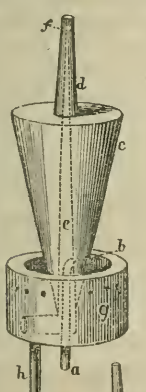
tube, which descends down through the bulb into the gas recipient, g, through the holes or orifices of which the gas which is to be inflamed issues. The dots around the recipient represent these orifices, and h a waste tube to carry off any surplus oil.

The oil to be decomposed enters at the orifice of the supply tube, passes up that tube into the bulb, where it is converted into gas by the heat of the flame surrounding it. The gas rises to the top of the bulb, and turret, and passes down the gas tube into the recipient, whence it issues through the openings at which it is to be lighted. The surplus tube serves to conduct off any particles of fluid which may come down with the gas, and thus prevents obstruction.

In order to light the lamp, oil must be admitted into the bulb; this part may then be heated by a common candle or lamp, but it will be much facilitated by using a small blow pipe. When a small portion of gas issues through the openings in the recipient, it will inflame, and the generation and combustion be continued.

To preserve the oil at a proper height in the bulb, allowing a sufficient supply without endangering its raising too high, and flowing into the gas tube, several devices may be adopted, as by the common fountain lamp, or by using a stop cock, and adjusting it so that no more than the proper quantity shall enter.

S. Andrews' Gas Generator.



Silver, as being the best conductor of heat, and resisting oxidation, is esteemed the most suitable metal for making the apparatus.

"My new invention consists in generating and forming out of the oil, or other substance used for the purpose, the gas which continues and supplies the flame of the gas light, by the application of the heat of the inflamed gas itself to the oil or other substance used, so as to cause a continued gas light, and without the intervention or use of wick, to burn in contact with the flame, and in so constructing and forming the gas lamp, or machine, as to produce that effect."

SOLOMON ANDREWS.

Abstract of the Specification of a patent for a mode of commencing the generation of Gas in the Lamp described in the preceding specification, by means of a spirit lamp, filled with alcohol or other highly inflammable fluid. Granted to SOLOMON ANDREWS, *M. D. city of Perth Amboy, Middlesex county, New Jersey, May* 5, 1831.

IN lighting the lamp described in the foregoing specification it is stated that after oil has been admitted to the bulb, that part may be

heated by a common candle, or rather by the aid of a small blow pipe, in order to commence the decomposition of the oil, and its consequent conversion into gas. The present invention is intended to obviate the difficulties attendant upon these modes of commencing the combustion.

To effect this, the supply tube *a*, represented in the cut in the last article, is to be surrounded by a small cup, about the diameter of the recipient *g*. This cup is to be supplied with a small portion of alcohol, or other inflammable fluid which will burn without a wick; when this fluid is lighted, the flame produced by it will heat the bulb *c*, and convert a portion of the oil contained in it into gas. To supply this cup it is proposed to have a small reservoir, somewhat similar to that for oil; a tube from this reservoir, is to lead into the cup, a small stop cock allowing a portion to flow in when wanted.

"My newly invented improvement, which is the subject of this patent, consists in generating gas in the first instance of my new invented gas lamp or machine, and so as to put the new invented gas lamp, or machine, into operation, by means of the flame of the said alcohol, or other fluid, rising up and surrounding the bulb of the said gas lamp, or machine. And in so constructing and applying the spirit lamp, or machine, as to produce that effect."

Remarks by the Editor.—At page 32, of vol. I, (for Jan. 1828,) will be found a cut and description of a "self generating gas lamp," taken from the Edinburgh Philosophical Journal. Its principle of action resembles the foregoing, although the parts are differently arranged. In the Edinburgh lamp it is proposed to cause the generation of the gas to commence by the application of a small iron heater prepared for the purpose. Whatever ingenuity may be displayed, however satisfactory the operation of an instrument may prove, and how great soever may be the interest excited on its first introduction, if it is intended for ordinary use in domestic economy, there must be no greater trouble in putting it into operation than has attended the apparatus for which it is to be a substitute, or its chance of continued favour will be very small. The original "self-generating gas lamp," we apprehend, failed from this cause, and we are fearful that the one before us will be unable to surmount the opposition of chamber maids, cooks, and scullions.

Besides this difficulty, will there not be a rapid accumulation of carbonaceous matter in the reservoir, from the mucilage always contained in oil? There is no provision made for cleaning it out, nor does it appear easy to remove this objection.

We have seen the lamp in operation; the flame was clear, but somewhat flickering, a defect which probably was accidental. The oil did not appear to be perfectly converted into gas until it issued from the recipient into the flame; for, if extinguished at some of the orifices, it escaped from these in the form of a dense vapour, which the flame would have decomposed and converted into gas.

Specification of a patent for an improvement in Machinery for Blowing Wind, for the use of Forges and Furnaces. Granted to Daniel Strobel, Jr., *Civil Engineer, then of the city of Washington, but now of the city of New York, May* 9, 1831.

To all whom it may concern, be it known, that I, Daniel Strobel, Jr., have invented an improvement in the machinery for blowing wind, for the use of forges and furnaces, and that the following is a full and exact description thereof.

The principle which I have adopted has been already applied to the raising of water in pumps, in which the part operating as a piston has been made to work without friction against the sides of the chamber; but the form of the chamber which I have adopted, the general arrangement of the apparatus, and the application of it to the purpose of blowing, constitute my invention.

The accompanying drawing shows a longitudinal section of a double acting blowing machine on the before mentioned principle, (in this case supposed to be worked by the lever beam of a steam engine,) in which A and B represent two conical vessels joined together by flanches and screw bolts at their larger ends, and having their small ends joined to two square valve boxes, C and D. E represents a leather diaphragm, capable of assuming the conical form of one of the vessels; the edge of this leather is securely fastened to the conical vessel, (formed by the two vessels A and B,) by being bolted between the two flanches *a a*, *b b*, of the vessels A and B. The middle of the diaphragm is firmly secured to a metal or wooden disk, F, by being bolted or rivetted between the two plates, *c* and *d*, of which the disk, F, is composed. G, is a polished cylindrical metal rod securely fastened by one end to the centre of the disk, F, the other end communicating with the moving power. H, is a stuffing box containing two cupped leathers through which the rod, G, works:—the cupped leathers, stuffing box, and its gland, are too well known to need any description. *e*, *f*, *g*, *h*, are four hanging valves, *e* and *f* communicating with the atmosphere, and *g* and *h* with two passages, I and K, leading from the valve boxes, C and D, to the air vessel or regulator. The regulator is constructed on the same principle as the blower, being composed of two conical vessels, L and M, connected together by their larger ends in the same manner as the vessels A and B. The smaller end of the vessel L, is joined to the horizontal passage K, whilst the smaller end of M is open to the atmosphere. The vessels L and M contain also a leather diaphragm, N, similar to E, which diaphragm, N, is connected to the vessels L and M in the same way as E is connected to A and B. To the middle of the diaphragm N, is affixed a disk, O, in the centre of which is fastened a metal or other rod, P, which passes through a guide, Q, adapted to the vessel M. The upper end of the rod, P, carries a weight, R, which must be proportioned to the density of the blast desired. To the horizontal passage, K, is fixed the pipe, S, conveying the blast where it is required. The operation of this machine is as follows—motion being communicated to the rod G, (which is supposed to be

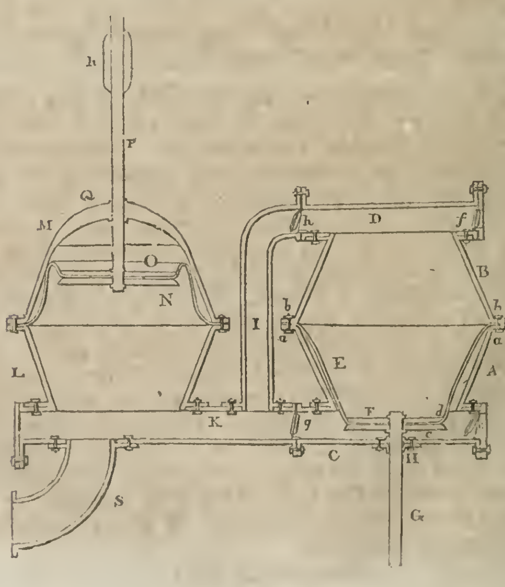
just ascending,) a partial vacuum will be formed in that part of the blower situated below the diaphragm E, at the same time the valve *c* will open, and the atmospheric air will rush through it to restore the equilibrium, whilst the air, situated above the diaphragm E, will become compressed until its elasticity becomes sufficient to force open the valve, *h*, leading to the regulator. As soon as the rod, G, begins to descend, the valves *c* and *h* will close, and *f* and *g* will open; *f* admitting air above the diaphragm, and *g* permitting that below to escape into the regulator. The regulator keeps up the continuity of the blast, which would otherwise be interrupted at the change of stroke, by an enlargement or a diminution of its capacity, in a manner which will be readily understood from the annexed drawing.

In constructing this apparatus I do not intend to confine myself to the particular arrangement which I have exhibited, or to the precise form given to the wind chambers. The latter may be barrel shaped, or otherwise enlarged towards their middle, for the purpose of allowing free play to the leather diaphragm, this being the object of the enlargement. The machine also may be made single, instead of double, with the regulator placed immediately over the blower.

What I claim as my invention, and for which I ask a patent, is the application of a vessel, such as I have described, with its diaphragm and disk, to create a blast both in the ascending and descending strokes, upon the principle herein set forth. And the employment of a regulator, acting in the manner, and for the purposes which I have fully explained in the foregoing specification.

DANIEL STROBEL, JR.

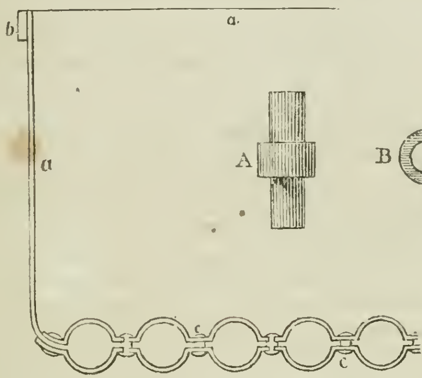
Strobel's Blowing-Machine.



Specification of a patent for an improved mode of applying the heat from steam to the purpose of concentrating Sirop, or Cane Juice, &c. Granted to Daniel Strobel, *jr. then of the city of Washington, but now of the city of New York, May* 9, 1831.

To all whom it may concern, be it known, that I, Daniel Strobel, jr. have invented an improved mode of applying the heat from steam to the purpose of concentrating sirop, or cane juice, and other articles in which this process is required; which invention is also applicable in the process of distillation, and that the following is a full and exact description of the same; reference being had to the drawings which accompany this specification.

Strobel's Evaporating Pan.



The still, or evaporating pan, may be made in any of the usual forms, and of any suitable metal, my improvement consisting in the manner in which the bottom is constructed. The accompanying cut represents a part of an evaporating pan, cut through by a vertical plane passing through it, perpendicularly to its length. *a*, shows the sides of the pan. *b*, an iron band passing round it, and secured by rivetting, or otherwise. *c*, *c*, shows the manner of making the bottom, which is double, being formed of two or more plates of metal, between which the steam is to pass. Each plate is indented, fluted, or grooved, in the manner represented in the drawing; each groove forming one-half of a cylindrical, or other formed, cavity. The two plates are then to be tied together by means of rivets; not, however, in such a way as to cut off the communication between them, but allowing a free passage of steam from one to the other. For this purpose I intend generally to make the rivets with a double shank, as shown enlarged at A, the projection between the shanks, serving to separate the plates. The same end may be attained by washers, or by strips of metal crossing the flutes. B shows a horizontal projection of the double shank rivet.

The double plates, forming the cavities herein described, instead of forming the bottom of the evaporating pan, may be placed within any of the pans now in use, parallel to, and elevated a little above the bottoms of them, thus exposing the sirop, or liquid, to the action of both sides of the heated metals.

I do not particularize any mode or manner of introducing the steam, as this is familiar to every machinist, or engineer; nor is it necessary to describe the modifications which will be required when the double plates are elevated above the true bottom of the pan, as these also are sufficiently obvious without such description.

What I claim as my invention in the apparatus hereinbefore described, is the indenting, fluting, or grooving of plates of metal, and tying or uniting the same together for the purpose, and upon the principle which I have set forth. Daniel Strobel, Jr.

Specification of a patent for a Composition for the making of Beer. Granted to Stephen Hinds, *Montrose, Susquehanna county, Pennsylvania, May* 11, 1831.

To all to whom these presents shall come, be it known, that I, Stephen Hinds, of Montrose, in the county of Susquehanna, and state of Pennsylvania, have invented a new and useful composition for the making of beer, and that the following is a full and exact description of the composition and process of compounding the same as invented by me, to wit: one pint of molasses, one pint of new milk, and one pint of common hop yest, are put into a six gallon keg, which is then filled with air, by means of a pump, or in any other mode most convenient, until no more can be compressed into the cask; it is then corked up, and let remain in that state for twenty-four hours. At the expiration of that time, two gallons of water are mixed with one quart of molasses, one ounce of ginger, half an ounce of allspice, and half an ounce of the essence of spruce, heated boiling hot, and put into the cask, with three and a half gallons of cold water, again corked up, and permitted to remain twenty-four hours longer. The beer will then be fit for use. When the beer is drawn out, except two quarts of the sediment, which should be left in the cask, the last described composition can be again added to it, and so on during the season.

What I claim as new and as my own invention in the above described manufacture and composition, and for the use of which I ask an exclusive privilege, is the composition first above described, the proportions of the second described composition, and the whole process of making.

The whole of the beer should be drawn without a vent. The carbonic gas generated in the beer, renders one unnecessary.

Stephen Hinds.

Specification of a patent for an improved Machine for Cutting Grass and Grain. Granted to William Manning, *Plainfield, Essex county, May* 3, 1831.

I provide an axle tree with two wheels, of the common construction. To this axle tree I attach shafts, by which a horse is to draw the machine. From the axle tree extend two arms in the direction of the shafts; these arms are morticed into, or otherwise attached to the axle tree; they are of greater length than the shafts, extending beyond them a sufficient distance for the cutting apparatus to be entirely clear of the horse. The two arms are united together by a cross bar at their extreme ends; which cross bar, when the machine is in action, rests, and slides forward on the ground; teeth of six or eight inches in length, more or less, are set like rake teeth, standing forward on the cross bars. These are made slender, and are for the purpose of holding the grass or grain to be cut.

The cutters stand immediately above the teeth; and receive a traversing motion in a way to be presently described.

A flat bar of iron lies along upon the cross bar, and the cutters are to be attached to this upper bar. The cutters are spear shaped, and are sharpened on each of their edges. They may vary in their length and width, but ordinarily they may be about six inches long, and three or four wide at their bases. The grass or grain which is held up by the teeth, passes between these knives, or cutters. To give a traversing motion to them, a lever may extend from the inner end of the hub of one or both of the wheels, to the cutter bar; this lever may work upon a pin at or near its centre; a zigzag groove in the hub, or in a wheel attached to it, will give it a vibratory motion, and its connexion with the cutter bar at the opposite end, will cause that to traverse.

I intend sometimes to make the cutters revolve instead of traversing. They are then to be fixed upon the periphery of a wheel; the teeth being placed on a fixed semicircle. The cutters will then have one sharp edge only. The wheel may be made to revolve by bands, or gearing, from one of the main wheels, in various ways.

When the machine is small, it may be moved by the power of a man. The shafts may be fixed forward of the cutters, and the general arrangement be varied, without altering the main principle of my machine.

What I claim as my invention, and for which I ask letters patent, is the combined action of the teeth and cutters, whether the cutters are moved in a traversing or a revolving direction.

William Manning.

ENGLISH PATENTS.

To Thomas Botfield, *coal and iron master, for his invention of certain improvements in making iron, or in the method, or methods, of smelting and making of iron. Sealed 2nd January,* 1828.

Two leading features are proposed by the patentee as novel in connexion with the smelting of ore, which are the adaptation of a high chimney to promote a draft of air in a blast or cupola furnace, and the employment of salt or other substance containing soda in the process of smelting the ore.

The particular form of construction of the apparatus does not appear to be important, it is simply proposed to erect a high chimney contiguous to the cupola, with channels, or flues, leading from the lower part of the furnace, opposite to the tuyere hole, where the blast of air enters, and also from the upper part of the cupola into the high chimney, by means of which a very considerable draft will be produced through the tuyere hole, and the ore become more effectually operated upon by the consequent increased heat of the furnace, than in the ordinary construction of blast furnaces.

As it is considered that the employment of heated air would improve the blast, and be beneficial to the metal produced, a small furnace or heating stove is placed contiguous to the tuyere hole, and a current of air passed through it, which air, after it has become heated, is brought into the blast at the tuyere hole, and is carried through the furnace by the draft of the chimney.

The employment of salt, or other material, containing soda, is confined by the patentee to the operation of smelting the ore. The same was used by Mr. Duckock, for manufacturing iron in the puddling furnace. [*Lond. Jour. of Arts and Sciences.*

To James Smethurst, *lamp manufacturer, for an improvement, or improvements, in lamps, communicated to him by a foreigner residing out of the British dominions. Sealed 6th November,* 1827.

This invention is a lamp for the table, on the hydraulic, or fountain principle, in which the oil is made to rise up a column to the burner, by the pressure of a descending column of some heavier fluid. The oil is placed in a receptacle near the bottom of the pedestal, from whence it is intended to rise through a perpendicular pipe to the burner. A reservoir of water, or other fluid, is placed in the upper part of the pedestal, which descends by a pipe to the under part of the oil vessel, and there opening a valve upward, enters below the column of oil in the receptacle, and gradually raises it in the column up to the wick.

The principle on which this lamp is intended to act is by the difference of specific gravity between the oil and the water, or other

fluid employed in the descending column, which the patentee states, should be in the proportion of two to three. The form of the pedestal and shaft may be cylindrical, or of various other shapes, containing the reservoirs and pipes within.

When the charge of oil has been consumed, in order to recharge it, a high funnel is affixed to the top of the column, near the burner, into which the oil is to be poured, when by the superior height and consequent preponderating weight of the oil in the funnel above the burner, the water, or other fluid, will be forced back again into its elevated chamber, and will have no power to expel the oil from its receptacle until the high column in the funnel is removed.

The lamp is furnished with a receiving vessel for the occasional small overflow of oil, and also a vent aperture for the purpose of allowing the water to flow; and in its general appearance resembles other table lamps constructed upon the fountain principle. [*Ib.*

To Charles Derosne, *Gentleman, in consequence of a communication made to him by a certain foreigner residing abroad, and inventions by himself, for an invention of certain improvements in extracting Sugar or Sirop from Cane Juice and other substances containing sugar, and in refining sugar and sirops. Sealed* 29*th September*, 1830.

This invention consists in a mode of discolouring sirops of every description, by means of charcoal produced by the distillation of bituminous schistus alone; or mixed with animal charcoal, and even of animal charcoal alone.

Whatever sort of charcoal it may be, it must be disposed on very thick beds, on a filter of any suitable form. The filter of itself has nothing peculiar, and does not form the object of the patent, because it is already known and used for other purposes, but till now it has not been employed for discolouring sirops.

To obtain this discolouration, the charcoal is put in a case, in which is placed, at the distance of about an inch from the bottom, a metallic diaphragm pierced with a great number of holes; upon this diaphragm is placed a coarse linen, or woollen cloth, which exactly covers it; and upon this cloth a bed of charcoal of bituminous schistus alone, or mixed with animal charcoal, or animal charcoal alone, as above said. Whatever it may be, this charcoal ought to be in a finely divided state, in order that it may be well penetrated with the sirop which is intended to be filtered. Charcoal in powder would not be penetrated by the sirop.

It has been found that charcoal reduced to the size of fine gunpowder, is very fit for this operation; if the grain is too large, the filtration would operate too rapidly. The charcoal should be lightly pressed, and then new beds of the same charcoal placed upon it, which should likewise be pressed till it has come up to the height of fifteen or sixteen inches. It may be made higher if found necessary,

or it may be less, but the discolouring effect will be always in proportion to the thickness of the bed of charcoal.

When the charcoal is disposed to the proper thickness, it is to be covered with another metallic diaphragm, pierced likewise with holes, upon which is spread another clear linen cloth; upon this cloth the sirop is to be poured which is intended to be discoloured. The sirop ought then to form a bed of several inches thick, from four to eight, although there is no precise rule.

For operating well in the filtration of sirops, the sirop ought to be clear before pouring it upon the filter, and ought to have undergone a first filtration by the ordinary means; the object to be obtained by this filtration through the thick beds of charcoal is only the discolouration of the sirops.

The sirop to be filtered ought not to exceed the consistence, which is produced by two-thirds of sugar, and one-third of water; but it may be filtered at any less degree of consistency according to the result required. When the sirop is hot the filtration operates a great deal more rapidly.

In operating on a great scale, a reservoir filled with sirop can furnish several filters at one time. The first portion of sirop which passes through the filter is always the least coloured, and by the time the colouring part combines itself with the charcoal, the effect of the last portion becomes less sensible. That portion of sirops, which retains a part of its colour after filtration, can be passed again through another bed of charcoal in another filter, and by this means it may be obtained in a great degree of purification.

Whatever the kind of charcoal used, it is desirable to mix the charcoal with about one-sixth part of its weight of water before putting it in the filter. The place of that water is occupied by the sirop which penetrates the beds of charcoal; and when the water comes at first, it has a disagreeable and salted taste, when the animal charcoal is used, the water after that comes mixed with a portion of sirop, and soon after it is displaced by the pure sirop.

When the charcoal has been deprived of its discolouring effect, water is to be poured upon the filter for dissolving or displacing the sirop which may be mixed with the charcoal, the sirop then comes pure first, and after that mixed with more or less water, using as little water as possible. It is convenient to suspend occasionally the effusion of water on the upper part of the filter by shutting its cock. The sirop being heavier than the water, gains the bottom of the filter and runs first.

The sirops made with raw sugar by this process can be made as clear as water, the molasses are deprived of their bad taste, and are converted into a good kind of sirops of a clear and yellow colour.

The sirops from which it is desired to separate the colouring matter can be obtained directly from the juice of cane, or of beet root, or from the saccharine matter produced by the action of sulphuric acid upon the farinaceous matters, before these juices or liquids have been baked for extracting the sugar. The sirop may likewise be produced from the solution of all kinds of sugar, and of the products

of inferior quality, which are obtained in sugar refining under the name of "bastards" and other sugars. The purpose of producing of sirops may be to sell them in such a state for the ordinary consumption, or to bake them for making sugar whiter than is obtained by the common process, or these whitened sirops may be used for discolouring the refined sugar, in making them filter through the loaves, instead of the earth and water commonly used.

The object of the invention being to obtain discoloured sirops by the means above described, this discolouration of sirops is always proportionate to their primitive colouration, and to the quantity of charcoal which is used.

In the carbonization of bituminous schistus there is nothing peculiar; it is produced in close vessels, as is done for producing animal charcoal, only it is convenient before the carbonization, to separate from the bituminous schistus the sulphurets of iron which are mixed with it. Instead of using the schistus, or animal charcoal of the size of gunpowder, it can be reduced to a powder still more fine, mixed with sand. In this state a given quantity of charcoal discharges the colour better than powdered less fine, but the filtration is slower, and more difficult to be regulated. The patentee says, "having tried this method, I have given the preference to the other mode, but both of them are the object of the patent." [*Ib.*

To JOHN HENRY GUNTHER, *piano forte manufacturer, for his invention of certain improvements on piano fortes. Sealed* 10*th July*, 1828.

THIS invention is the adaptation of an additional sound board to piano fortes, which is to be made much stronger than the ordinary sound board, and to be placed above it. This board is proposed to be made of hard wood, about a quarter of an inch in thickness, but rather thinner towards the base; it is to be fastened to the framing of the instrument, and made particularly firm and capable of sustaining the tension of the strings, as the bridge and rails for the hitch pins are to be affixed to it. This and the ordinary sound board are to be connected by blocks, so that they shall both vibrate together; and it is stated that the adaptation of this improvement to piano fortes, whether of the horizontal or upright kind, very greatly improves the strength and tone of the instrument. [*Ib.*

To PETER RIGBY WASON, *Esq. barrister at law, for his having invented a certain improvement in the article commonly called stick sealing wax. Sealed 25th September*, 1828.

THE patentee has experienced what every one who seals a letter with wax must also have experienced, the great inconvenience of not being able to keep the stick of sealing wax in a blaze, or to make the wax flow on the paper, without the trouble of several times relight-

ing the stick; no one, however, that we have ever heard of before the patentee, has suggested the simple idea of placing a wick through the centre of the stick, which ingenious thought forms the subject of this patent.

The material, or composition, of which the sealing wax is made, though not claimed as new, is described as consisting of shell lac one part, vermilion one part, and Venice turpentine one part, (by weight we presume,) which are to be reduced into a mass over a slow fire, and when thus properly mixed, the portion which is to constitute a stick, is to be rolled out to its proper dimensions upon a heated copper plate: when that is done, a groove is to be formed along the middle of the stick, and a straw inserted, which is to constitute the wick. The stick of wax is then to be rolled again upon the heated copper plate, for the purpose of enclosing the wick, and being afterwards marked with such patterns or devices as may be thought desirable; on becoming cold the stick is ready for sale, or for use.

On lighting the end of this improved stick of sealing wax, the straw will sustain a small flame, which will, as a taper, keep the wax in a blaze, and flowing as long as may be required. [*Ib.*

To Samuel Brooking, *Esq., a Rear Admiral in the Royal Navy, for his invention of a new method or mode of making sails of ships, and other vessels. Sealed 4th September,* 1828.

It has been found that in consequence of the strain which is given to sails in angular directions, by the pressure of the wind, they invariably stretch from corner to corner, and bag in the middle, which causes them to be much sooner destroyed than they would otherwise be, if the strain was supported by a diagonal seam. It is therefore the intention of the patentee, instead of making sails by joining the breadths of canvass in perpendicular directions, to make the seams diagonally, that is, from corner to corner of the square sails, and in such manner crosswise of all other formed sails, as to give that strength and resistance in the direction of its greatest tension, which will prevent the stretching of the fibres of the material, and render the sails much more durable.

There does not appear by the specification, to be any novelty proposed in the mode of making the canvass, or in the forms of the sails, but merely in the way in which the canvass is to be cut, and the direction in which it is to be sown together, to make the sails, which constitutes the subject of this patent. [*Ib.*

Patent granted to Joseph Budworth Sharp, *Esq.*, *and* William Fawcett, *of Liverpool, Civil Engineer, for an improved mode of introducing Air into Fluids for the purpose of Evaporation. Dated October* 20, 1830.

In the drawings of this specification a tube is represented suspended vertically over a circular pan, from the lower end of which tube two smaller ones radiate horizontally, and nearly touch the sides and bottom of the pan. The vertical tube, which is perforated at the upper part, works easily in brasses placed in a suitable framing, and by means of proper gear, is made to revolve in a horizontal direction. The result of this, it is assumed, will be, that by the movement of the radiating pipes in the liquid, an inclination to a vacuum is created; and the air, from this circumstance, rushing through the aperture at the top, passes through the liquid and causes a great evaporation, whilst the constant motion of the pipes prevents the liquid from collecting on the sides of the pan and carbonizing.

The nature and properties of the Sugar-Cane, with practical directions for the improvement of its culture, and the manufacture of its products.—By George Richardson Porter.*

[Continued from vol. vii. p. 342.]

When all is properly prepared for each operation, and the reservoirs for the expressed juice are filled with a known and fixed quantity, it is made to flow into the first clarifier. The proportion of quick lime, for separating the feculencies, should be immediately ascertained. For this purpose, an hydraulic balance should be used; this was invented by an Englishman, and introduced, two or three years ago, into St. Domingo, (1789.) This balance, which is very ingenious, serves to show the quantity of feculencies which exist in the expressed juice, and the quantity of lime necessary to separate them. Although it may not rigorously indicate what is the necessary quantity for the complete clarifying, it is, however, very useful in determining the quantity of lime which ought to be employed in the first instance. Its use is extremely safe, as the proportion of lime which it indicates is never in excess. The lime thus weighed is put into the juice with which the first clarifier is filled. That its action may take place at the same time over all the juice, great care is taken to spread it, by agitation, for a minute or two, with a ladle; then it is poured entirely into the concentrator; after having filled all the boilers with a charge thus tempered, heat is applied. The coppers, of course, receive a degree of heat relatively to their proximity to the fire place. The juice of the concentrator, therefore, is the first whose feculencies separate; the action of the heat proceeds successively through the boilers. The first feculencies are removed by the scummer, from each of the boilers, as fast as they rise to the

* This valuable work has been recently republished by Messrs. Carey & Lea.

surface of the fluids; they are poured into wooden buckets, and carried to their place of destination. Those of the first clarifier are poured into the basin, which is between it and the wall, from whence they flow out into the vessel placed there to receive them. The impurities of the second sort are poured into the little basins, on the surface of the laboratory. The juice, which is unavoidably removed with them in scumming, carries them through the channels into the first clarifier, where they are again removed with the scummings of this copper. The scum is taken off as fast as it is produced, and to each charge, if it be thought necessary, lime in substance, or lime water, or some other alkali is added. When the sirop of the concentrator indicates twenty-two or twenty-four degrees of the saccharometer, the fire is damped, and the sirop is laded into the basin which communicates with the vessel. Immediately after having emptied the concentrator, it is filled again with the *entire* charge of the evaporator, the heat is continued, and the contents of each copper pass successively from one to the other till they reach the evaporator, leaving the first clarifier empty, and this is immediately supplied with a fresh accession of juice. In the mean time, as fast as the cane liquor reaches the vessel, placed at the foot of the reservoir, it is poured upon the filters, and falls into the reservoir, freed from the solid matter which it contained. The scumming and evaporation are continued—the contents of one copper are passed successively into another—the sirop in the concentrator is passed into the vessel, and thence into the reservoir for subsidence, till this is filled. The different steps of the work should be so disposed, that the first reservoir for subsidence should be filled about six or eight o'clock in the evening. Then the sirop, always evaporated to the same degree, is conveyed in the same manner to the second reservoir, by the canal which communicates with it, and this work is continued through the night. Towards five or six o'clock in the morning the fire is damped, and the concentrator is emptied; after well washing it, if required, the valve of the first reservoir is raised, the filtered cane liquor runs perfectly pure into the concentrator, having deposited, during eight or ten hours of perfect rest, the feculent and earthy particles which, owing to their extreme fineness, had passed through the filters.*

When the concentrator is charged by this means, with a quantity of sirop suitable for making a boiling, the valve is shut, and it is ascertained whether the clarifying is well and perfectly done. For this purpose some sirop is taken in a silver spoon, and inspected in

* Monsieur Bonmatin gave an account, in the year 1814, of his method of extracting sugar from beet root, which appeared to the French government to have so much importance, that they caused it to be printed and distributed in those departments where that branch of manufacture was followed. In this account Monsieur Bonmatin states, as one part of his process, that after the evaporation of the juice to the state of sirop, as indicated by 32° of Beaume's saccharometer, and before its concentration, to obtain crystalline sugar, he allows the sirop to rest during four days, in order that all the foreign matters which it contains may subside.

different points of view, in order to ascertain that it contains nothing perceptible to the eye. Some drops of lime water are poured into this sirop, which should appear very clear and transparent, and it is then examined anew.

If after one or two minutes no solid particles are perceived to swim in the liquor, we may be assured that the clarifying is complete. Heat is then applied to finish the evaporation and concentration. If the sirop is suspected to be of bad or middling quality, then a test of caustic alkali, well filtered and mixed with lime water must be employed. If the action of these agents causes the appearance of any flakes of feculent matter, then a temper of lime or other alkali is put into the sirop, in proportions regulated by the quantity of the flakes, which, in this case, are always very trifling. They are soon separated by the concurrent action of the temper and heat, which raises them to the surface, whence they are easily removed by the scummer. When the colour of the sirop is a very deep brown, and lime water and alkalis fail to separate any feculencies, it may be presumed that its darkness is, in part, owing to an excess of temper, which holds the mucilage, and sometimes also a portion of the second feculencies, in solution. In this case very diluted sulphuric or oxalic acid may be used as a test, for if the alkali is in excess, either of these acids will precipitate it in the form of a neutral salt, and the acid will also affect the colouring part of the mucilage: the base of this juice is then precipitated in the form of white flakes, and any portion of the second kind of feculencies, which the alkali may have held in solution, is likewise precipitated. To remedy this excess of alkali, very diluted sulphuric acid, or cream of tartar, citric acid, or oxalic acid, may be used. But to employ these different acids with success, a person must be well acquainted with their properties. They may, however, be dispensed with in the method we are now explaining, by being careful to procure good lime, and weighing it with accuracy. While the charge of the first concentrator, and all the contents successively, of the first reservoir, are being concentrated, scumming and evaporating are continued in the three preceding coppers, and the sirop of the evaporator, after being carried to the proper point of concentration, is passed from this copper to the second reservoir, always through the little basin and the canal which communicates with it; this reservoir continues to be thus filled, (always previously passing the sirop through the filters,) till all the contents of the first reservoir are concentrated; this ought to happen at about six or eight o'clock in the evening; at this moment the charge of the evaporator is passed into the concentrator, which is again converted into an evaporator.

If it is requisite, the first reservoir for subsidence is washed, and then it is filled anew, as at first, with the sirop, evaporated in the concentrator to the proper fixed point. The second reservoir is left to subside during the night, and at five o'clock in the morning the boiling of the sirop from this reservoir is begun, similarly to that from the first reservoir on the preceding day. This order once established, it continues always in the same alternation. Thus, in this

work, each charge of expressed juice passes from one copper to another without being mixed, and receives, successively, the degrees of heat most proper for its different stages of clarification and evaporation. The temper of each charge can be regulated according to the signs presented by the scum, and to the bubbles formed in ebullition, &c., but to these signs implicit confidence must not always be attached. All the solid matters which have escaped the scummer, are most successfully removed by the filtration and subsidence to which the sirop is subjected, without any increase of labour, since the progress of this method does not require a greater number of negroes than is ordinarily employed in the usual method. The clarifying and evaporating begin almost at the same time, and advance together to the reservoirs for subsidence, where the clarifying is entirely finished. The action of heat upon the feculencies ought to be moderate, a too slow or too rapid heat are both injurious. In these coppers it can be graduated at will, the shape and material being favourable for this desired effect. When once the power of the furnace is known, the charge of the clarifier can be regulated accordingly, by augmenting or diminishing the quantity of the expressed juice in such a manner that it may arrive at the desired point of clarification in the required time.

The sirop is never evaporated to such a density as in any way to injure or obstruct the separation and removal of the feculencies by the scummer. The charge of the first clarifier being from 250 to 370 gallons of juice, and this charge passing entire from one copper to another, the proportion of water which the cane liquor contains, is always great enough to allow free scope to the feculencies to separate and be disengaged by the scummer; for, however rapid the evaporation may be, its progress can be regulated at will to the fixed point for filtration and subsidence.* This point is ascertained by the saccharometer, an instrument formed of a bulb of copper, two or three inches in diameter, attached to a tube six or eight inches in length. This saccharometer is charged with grains of lead, adjusted in such a manner, that, at the 24th degree of Beaume's scale, the bulb, plunged in the fluid, would be just covered to the commencement of the tube. The negro boiler being made acquainted with this point, is charged to watch the work; it may with safety be abandoned during the night to his guidance, as the concentrating only takes place during the day; the negroes have nothing more to do than to weigh the lime for each charge of the expressed juice, which is put into the clarifier, then to scum and pour the cane liquor on the filters. The progress, in the usual method, with iron boilers, has none of these advantages; on the contrary, they have the opposite defects.

After the account we have given of the progress of clarifying, evaporating, and concentrating, in the laboratory, with the four copper

* The rapidity of the evaporation can constantly be ascertained by reference to the table, page 206; that, connected with the use of the saccharometer, should regulate the progress.

boilers, it is easily perceived, that when these three operations in the laboratory are pursued as it is proposed, the different steps of the work will, although divided, be absolutely the same. The concentration performed in a single vessel, over one fire, or in the laboratory with a double furnace, will not, in any way, be different in its execution to that in a laboratory with four coppers; it will only require the attendance of a few more negroes; but in a large plantation it is essential that the work should be performed very rapidly, and therefore its steps should be more divided.

The cane liquor being now entirely deprived of all solid matters by the means just described, it can be concentrated to the required point, its state being fully ascertained before concentration, and the defect, (if any,) in alkali being easily remedied.

The advantage of concentrating only during the day is very important, as the overseer can thus bestow his attention and care upon the concentration of the whole, without being obliged to watch all night; the operations during this period being reduced to those of clarifying and evaporating, may safely be entrusted to the negro commander or head boiler, who is one of the most trust worthy persons on the plantation.

The proportion of essential salt which the cane liquor contains, cannot by any means be augmented—the sweet and saccharine mucous juices cannot be converted into sugar—nor can the former and the mucilage be removed before the complete concentration of the sirop, since those juices are more soluble than the essential salt. The end proposed then, is to extract the greatest possible quantity of this salt in the best possible state; for this purpose we must borrow the aid of chemistry, the principles of which are much more required in the concentration and crystallization of middling and bad sirop, than in that of good quality. The sweet and saccharine mucous juices, cannot support nearly as high degrees of heat as the essential salt; they are immediately decomposed by the application of degrees of heat, which may safely be used to sirop of good quality. The business of concentration, as we have before observed, is the action of heat upon the water of solution of the sugar. The sugar-boilers, both of America and Europe, have rarely had a just conception of the action of heat in the operation of concentration; their knowledge has generally been confined to some terms, which serve to designate the particular state in which the sirop under concentration is found; the recollection of these terms too often makes up the whole science of the sugar-boiler.

Concentration being the action of heat upon the water of solution, ought necessarily to begin and terminate at fixed degrees of the thermometer. The truth of this position Dutrone affirms to have been demonstrated to him by multiplied experiments, made with solutions of sugar, refined to a state of perfect purity, and to which he applied the action of heat at each degree, commencing at 83°, and ending at 110° of Reaumur. This scale is not in use in England or her colonies, and, therefore, in the following table we have added another column, with the corresponding degrees in the scale of Fahrenheit.

Each of the experiments was made with a solution of one hundred pounds of sugar in sixty pounds of water. When the degree of heat indicated by the thermometer is ascertained, a reference to this table will show, at one glance, what proportion of the water of solution has been evaporated—what quantity of sugar is thereby rendered capable of passing to the solid state—and how much water is yet to be evaporated before the remainder of the sugar can be crystallized. If, for example, during the process of concentration, the thermometer rises to 230° Faht. or 38° Reaumur, this table informs us, that 31 lbs. 3 oz. 4 dr. of water have been evaporated, that 52 lbs. of sugar have thereby been rendered capable of crystallizing, and that 28 lbs. 12 oz. 12 dr. of water remain to be evaporated, before the remainder of the sugar, 48 lbs., can assume the solid form.

Table of the action of heat upon a saturated solution of sugar commencing at the point of saturation, and terminating at the point of perfect crystallization.

Degrees of thermometer.		Water of solution evaporated at each degree.			Products of crystallized sugar at each degree.			Water which remains combined to the sugar in the state of sirop, after the crystallization at each degree.			Sugar which remains combined with the water in the state of sirop at each degree.		
Fahrenheit.	Reaumur.	lbs.	oz.	dr.	lbs.	oz.	dr.	lbs.	oz.	dr.	lbs.	oz.	dr.
219	83	0			0			60			100		
221	84	4	12	14	8			55	3	2	92		
223	85	11	8	14	19	4		48	7	2	80	12	
225.5	86	18			30			42			70		
228	87	24	9	10	41			35	6	6	59		
230	88	31	3	4	52			28	12	12	48		
232	89	33	11	10	56			26	4	6	44		
234.5	90	36	3		60	5		23	13		39	11	
237	91	38	1		63	4		21	15		36	12	
239	92	39	4		66	3		20	12		33	13	
241	93	41	7	10	69	2		18	8	6	30	14	
243.5	94	43	4		72	1		16	12		27	15	
246	95	45			75			15			25		
248	96	46	7	4	77	7		13	8	12	22	9	
250	97	48	7	8	80	5		11	8	8	19	11	
252.5	98	50	1	10	83	3		9	14	6	16	13	
255	99	51			85			9			15		
257	100	52	5	14	87	4		7	10	2	12	12	
259	101	53	1	6	88	6		6	14	10	11	10	
261.5	102	54	1		90	1		5	15		9	15	
264	103	55	3	10	91	4		4	12	6	8	12	
266	104	55	12		92	7		4	4		7	9	
268	105	56	7	10	94	2		3	8	6	5	14	
270.5	106	57	3	8	95	5		2	12	8	4	11	
273	107	58	6	8	97			1	9	8	3		
275	108	58	14	8	98	2		1	1	8	1	14	
277	109	59	7	10	99	2			8	6		14	
279.5	110	60			100								

Although soluble matters, other than the essential salt, are combined with the water of solution, the water is, nevertheless, always united with it in a relative and determinate proportion: the thermometer ought, therefore, to be employed to determine its concentration, the solid product having always relation to the proportion of water which the heat has evaporated at each degree of this instrument. If the extraneous matters exist in a greater abundance, the quantity of pure sugar will be less than that marked in the foregoing table.

The use of the thermometer in concentration, far from excluding the proof of the finger, which is very convenient, serves, on the contrary, to render its practice less equivocal, giving to the operator fixed rules, by which he may be more safely guided.

Sirop, when concentrated beyond the point of solution, assumes, in cooling, the crystalline form: experience shows us that the molecules of similar bodies, in taking this form, require to move freely in the fluid which holds them in solution, in order to their exercising upon each other their mutual attraction. These molecules take, in their union, a form much more regular in proportion as the water, in which they unite themselves, is more considerable. When the mother water exists in a great proportion, compared to the sugar which is to be crystallized, very large and regular crystals are formed; in this state it is called sugar-candy.* We know that salts are much more pure and perfect, as the forms they make approach nearer to those which nature has assigned to them. Sugar-candy is in the most perfect state that can be desired, and the means that it is proper to employ, to extract the essential salt of the cane, ought, therefore, to be founded on this principle of chemistry—*to crystallize in a considerable quantity of water*—a principle fully ascertained and established for all bodies which crystallize in cooling.

[*Repertory of Patent Inventions.*

Remarks on Lotteries.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—Although your journal may not, to some persons, appear to be the proper place to examine the subject of lotteries, yet as it is one which interests the labouring classes in an especial manner, this consideration may probably induce you to allow a page to an operative mechanic to present his cogitations to your readers. I am emboldened to do this from your having published in your July number, the specification of Mr. Jas. K. Casey's patent for what he denominates a *Self-operating Lottery.* It appears to me that the plan proposed by that gentleman, would, if carried into general effect, remove most of the evils which result from the nefarious and beggar

* Crystallizing in a great quantity of water should not be confounded with crystallizing in a great mass, as a planter of St. Domingo did, who had a crystallizing vessel made twenty feet long, ten feet wide, and two deep; the crystallization of sugar, with a proportionate large quantity of water, can be performed in the smallest vessels.

making schemes with which our country is inundated, to the utter ruin of thousands among the poor and thoughtless, who are induced to resort to this most pernicious mode of gambling; a mode by which they are swindled out of their hard earnings, to support and enrich some thousands of lottery ticket venders; a class of men who, to say the least, are among the most unproductive class of society. I have taken some pains to investigate the operation of the existing lotteries, and may hereafter, if not anticipated by some abler hand, offer you some calculations which I think will astound every one who has not put himself to the same trouble. No legislature, fully informed of the evil consequences of lotteries as at present constituted, would ever have tolerated so great an evil. In this city, (New York,) I have been gratified to see that a most respectable grand jury has, in effect, presented the present mode of managing and drawing lotteries as a nuisance of a most offensive and pernicious character; and this they have boldly and properly done, although the evil itself is legalized, and cannot, therefore, be immediately suppressed, but must for awhile continue to inflict its mischiefs *in due course of law.* I have somewhere seen it observed that "the worst poison is that which poisons the physic." Are the nostrums of the vilest charlatans, one half so deleterious as the quackery of our lottery puffers?

I know that among the contractors for lotteries there are some very respectable men; and do not they, who are so fully aware of the evil, owe it to the community to abate the nuisance, especially if there is any plan by which it can be effected whilst they may make a sufficiently profitable investment of their capital, by embarking it in a scheme which, whilst it would satisfy those who are disposed to make speculative adventures, would protect that class who are now made the wretched dupes of hope forever deferred.

I have no time to analyze *Mr. Casey's self-operating lottery;* it appears to me, however, obviously free from the most crying, if not from all, the evils incident to the existing plan of conducting and *drawing* lotteries. I wish that you, sir, or some other person qualified for the task, would undertake to enlighten the public mind more fully upon this subject, in doing which I am convinced it will be made fully manifest that a more extensive imposition was never practiced or endured. I hardly think it possible to influence the legislatures of all the states in our extensive country to prohibit lotteries altogether. In many places the public will probably continue to call for them, and in this case the question of the greatest importance is, how can this wish be gratified with the least possible inconvenience and loss.

Yours,

A Mechanic.

New York, August 20th, 1831.

Madder, Woad and Barilla.

We observe with pleasure that the Pennsylvania Horticultural society have instituted an inquiry in relation to these important sta-

ples; madder is especially interesting to the manufacturers of the United States, and as it is a very desirable object to ascertain how far its cultivation may be safely recommended to the agriculturists of this country, we have pleasure in republishing the circular of the Horticultural society, with a view to call the attention of our distant subscribers to it.

To our city readers we may state that the question has been proposed for discussion at the meeting of the Institute on the 22nd of September.

P. C.

[CIRCULAR.]

Philadelphia, November, 1830.

At a meeting of the Pennsylvania Horticultural Society, held on the 8th instant, the undersigned were appointed a committee to "inquire into and report what progress has been made in this country in the cultivation of dyers' madder, and whether it will be proper for the Horticultural Society to adopt any measures to extend its cultivation." They were also instructed to include in their inquiries, "the culture of Barilla, and its preparation for the purposes of commerce."

Impressed with the importance of the objects committed to their attention, they are desirous of collecting as much information as possible, before they adopt any conclusion upon the questions referred to them. This, they are aware, must depend, in a great measure, upon the liberal communication of facts and observations, on the part of those who are practically conversant with these articles, either as agriculturists, merchants, or manufacturers.

With this view, they respectfully request that you may be pleased to communicate to them such information as you may possess, in relation to the cultivation of either of these plants—to the extent to which they are raised in, or imported into, this country—to the preparation which they undergo to fit them for commerce—to the fluctuations which have been observed in their abundance, and price in our markets—to their adaptation to the soil and climate of this country—to the diversities observed in the qualities of merchantable madder, and barilla, and to the causes which are supposed to produce these diversities—in a word, to every point which can throw light upon this subject.

Being desirous of giving to their investigations the widest range, the committee prefer submitting it to your attention, under this general aspect, than under the more restricted one of formal questions. They hope that the extent to which these plants minister to several useful arts, will be a sufficient inducement to secure the attention of all such as take an interest in the success of our agriculture and manufactures.

Respectfully,

William H. Keating,
Samuel Breck,
Moses Brown. } *Committee.*

N. B. Please direct your communications on this subject to any one of the members of the committee, or to David Landreth, Jr., Corresponding Secretary of the Pennsylvania Horticultural Society.

Although the resolutions of the Society are restricted to the above mentioned plants, yet we shall be obliged to you if you annex any information you may possess on the subject of *Woad.*

Account of some experiments made at Mr. Laird's works, at North Bickenhead, with the New Low Pressure Boiler, on the exhausting principle of Messrs. Braithwaite and Ericsson, by ALEXANDER NIMMO, *C. E., Dublin, and* CHARLES B. VIGNOLES, *C. E., London.*

THE exhausting apparatus consisted of a fan wheel, with broad radial leaves, revolving within a close box or chamber, placed a little apart from the boiler, but connected with it by a passage leading from the flues traversing the boiler; a short tube above the exhausting chamber passed out to the atmosphere.

The furnace was attached to, and placed at the end of, the boiler, opposite to the exhausting apparatus, which latter being put to work, drew through all the turns of the boiler the hot air from the fire, which passed over the throat of the furnace through the bridge flue, and then successively through the other five turns of the flue arranged through the boiler, and, finally, was drawn through the exhausting chamber, and passed into the atmosphere.

The heat, which in the furnace was extremely intense, was absorbed by the water in the boiler, as the air rushed through the flues, and when passing up the tube or funnel from the exhausting chamber, was so far cooled that the hand and arm might be placed with impunity down the tube, the temperature not exceeding 180° Fahrenheit.

Not the slightest smoke was perceptible.

The following are the principal dimensions measured:—

	Ft. In.		Ft. In.	
Furnace.	2 0 deep.	Ash Pit.	1 0 deep.	The openings of the fire-bars equal to about half the area of the bottom.
	2 6 long.		2 6 long.	
	2 6 wide.		2 6 wide.	

	Ft. In.			
Exhausting Chamber.	2 6 high.	Outside dimensions.	Diam. of exhausting wheel, - - -	3 0
	3 6 wide.		Breadth of the same,	0 10
	3 6 long.			

Bridge flue or throat, from the furnace, 2 ft. 6 in. broad, 4 in. wide, 2 ft. deep - - - - - -	5—16 in. iron plates.
First turn of the flue, 4 in. wide, 2 ft. deep, 2nd, 3d, 4th, and 5th turns, 3 in. wide, 2 ft. deep, - - - - - - - -	¼ in. iron plates.
Whole length of the flues through the boiler,	45 feet.
Superficial area of the heating surface, -	247 square feet.

The contents of the water in the boiler, when filled, were from - - - - -	85 to 90 cubic feet.
The superficial area of the evaporating surface, nearly - - - - - - - -	33 square feet.
The proportion of the heating to the evaporating surface, nearly - - - -	$7\frac{1}{2}$ to 1.
Steam Chamber. { 3 ft. wide. 4 ft. 10 in. average depth. 4 ft. 6 in. long. }	Containing about 65 cubic feet.

Diameter of the safety valve, very nearly 5 inches; being 19 square inches area, which was loaded for a pressure of 4 lbs. on the square inch, giving 76 for the load. Of this, 66 lbs. of iron was placed in the boiler, and 10 lbs. allowed as the weight of the valve, rod, hook, handle, &c.

The water used was the salt water from Wallasey Pool, and filled into a large iron tank, the area of the surface of which measured $32\frac{1}{2}$ superficial feet.

The boiler was placed upon an open shed; the day was very cold, with thick rain. No engine being attached to the boiler, the exhausting apparatus was worked by a wheel and band from Mr. Laird's turning engine. The velocity of the circle of percussion of the leaves of the exhausting wheel, was determined to be about 77 feet per second, or upwards of 52 miles an hour. Mr. Laird's engine is stated to be a 4 horse power. No determinate measurement was made, but the engineers present computed, that the power applied to turn the exhausting wheel, was equal to that of two horses.

The fire being lighted, the steam was got up to 4 lbs. pressure in 45 minutes, with a consumption of $2\frac{1}{2}$ cwt. of coke. The expenditure at first was 8 lbs. per minute, and gradually decreased to 5 lbs.; averaging about $6\frac{1}{4}$ lbs. per minute for getting up the steam. The steam began to rise in 27 minutes, after which the consumption of coke was little more than 5 lbs. per minute; and at this period there would have been a sufficient supply of steam to work the cylinders of an engine.

The coke employed was gas coke, of very bad quality, of which $3\frac{1}{2}$ cubic feet weighed 105 lbs. giving 30 lbs. for the weight of a cubic foot, or 3000 lbs. as the weight of 100 cubic feet. The same weight of St. Helen's coal, (that principally used in steamboats,) measured 63 cubic feet. The cost of the coke used was 8*s.* 6*d.* per ton, delivered in Liverpool; the cost of Smithy coke being 25*s.* per ton, of which $3\frac{1}{2}$ cubic feet weighs 115 lbs., giving very nearly 33 lbs. for the weight of a cubic foot.

When the steam was up, the water in the thick glass gauge attached to the boiler, standing at $7\frac{1}{2}$ inches, the two men stationed for the purpose began to pump, a fresh supply of weighed fuel was placed on the floor, and the following observations were made:—

	Hours.	Min.	
At	3	32	began to pump.
At	3	54—	16 cubic feet of water were evaporated.
At	4	12—	27 cubic feet of water were evaporated.

Hours.	Min.	
At 4	19	—38 cubic feet of water were evaporated; and 2 cwt. of coke consumed.
At 4	32	—41½ cubic feet of water were evaporated, with a consumption of 252 lbs. of coke.

From which it appears, that only 6 lbs. of coke per cubic foot of water per hour was consumed, and the evaporation of a cubic foot of water per hour being generally considered the measure of a horse power, the conclusion is, that the boiler was a 40 horse boiler, and that the quantity of fuel requisite to work it is 2½ cwt. per hour, the expense of which is 12¾*d.* and as the consumption diminishes after the first hour, the expense of fuel will probably not exceed 1*s.* per hour for the forty horse boiler.

(Signed,)

Alexander Nimmo, C. E.
Charles B. Vignoles, C. E.

Oil for Chronometers.—By Mr. Henry Wilkinson, *of Pall Mall.*

From the Transactions of the Society of Arts.

The best olive oil in its recent state possesses that peculiar bland flavour which fits it for the table, and which appears to arise principally from the quantity of mucilage and water, either held in solution, or mechanically mixed with it. By keeping one or two years in jars, a considerable portion of the mucilage and water subsides, which renders such oil not only cheaper, but better qualified for yielding a greater proportion of *pure* oil than that which is recently expressed from the fruit. Two or three gallons skimmed from the surface of a large jar that has remained at rest for twelve months or upwards, is preferable to any succeeding portion from the same jar, and may be considered the cream of the oil. Having procured good oil in the first instance, put about one gallon into a cast iron vessel capable of holding two gallons; place it over a slow clear fire, keeping a thermometer suspended in it; and when the temperature rises to 220°, check the heat, never allowing it to exceed 230°, nor descend below 212°, for one hour, by which time the whole of the water and acetic acid will be evaporated: the oil is then exposed to a temperature of 30° to 36° for two or three days, (consequently winter is preferable for the preparation, as avoiding the trouble and expense of producing artificial cold; by this operation a considerable portion is congealed; and, while in this state, pour the whole on a muslin filter, to allow the fluid portion to run through; the solid, when redissolved, may be used for common purposes. Lastly, the fluid portion must be filtered once or more through newly prepared animal charcoal, grossly powdered, or rather broken, and placed on bibulous paper in a wire frame, within a funnel; by which operation rancidity, (if any be present,) is entirely removed, and the oil is rendered perfectly bright and colourless.

Henry Wilkinson.

Bibliographical Notices.

It has long been our design to give not merely a list of new publications relating to the useful arts, general science, internal improvements, and popular education, but occasionally to accompany the notice of them with such remarks as shall indicate our own opinion of their merits. In a work like the Journal of the Franklin Institute, reviews of this kind must necessarily be brief; we, however, shall treat such publications as may come under our notice with the same freedom and candour as have characterized our analysis of new patents. We shall be obliged by any aid given to us in our undertaking by the readers of this Journal; for, although situated in the political metropolis of the United States, we are without the means of a resort to Athenæums, Libraries, and Reading Rooms, such as exist in Philadelphia, New York, and Boston, where the new publications which would properly come within our province may always be found.

We are frequently asked what books we would recommend as best calculated for the instruction of those who wish to obtain information respecting the useful arts generally; and for the satisfaction of such persons we may occasionally advert to works of merit, which although they may have been for some time before the public, are not so extensively known as they deserve to be.

We know of some editors who have a happy talent at commending almost every work placed upon their desks by the kindness of authors or publishers; we shall be very glad to receive works in this way, but when we read, and more especially when we write about them, we shall be very apt to forget that they have been presented to us, and to sin against the old proverb which forbids our "looking a gift horse in the mouth." We hope, however, never to forget that courtesy which is always due to kind intentions; and will ever bear in mind that wantonly to wound the feelings of others is not the less a crime because it is one which is frequently committed.

The Introductory Discourse and Lectures delivered in Boston, before the Convention of Teachers, and other friends of Education, assembled to form the American Institute of Instruction. Boston, Hillard, Gray, Little & Wilkins, 8mo. pp. 352.

It is delightful to witness the public excitement which exists upon the subject of general education, and to see the wisest heads, and ablest hands, employed in directing the use of this most important of the instruments of public virtue, liberty, and happiness. The work before us consists of an Introductory Discourse by the Rev. President Waylard, of Browne University, and of thirteen Lectures upon various subjects intimately connected with education, delivered before a convention assembled in Boston, in August, 1830, for the purpose of forming an *American Institute of Education*. The lectures

are—On Physical Education, by John C. Warren, M. D.—On the Development of the Intellectual Faculties, and on Teaching Geography, by James G. Carter—On the Infant School System, by William Russell—On the Spelling of Words, and a rational method of teaching their meaning, by Gideon F. Thayer—On Lyceums and Societies for the Diffusion of Useful Knowledge, by Nehemiah Cleavland—A Practical Method of Teaching Rhetoric, by Samuel P. Newman—On Geometry and Algebra, by F. J. Grund—On the Monitorial System, by Henry K. Oliver—On Vocal Music, by William C. Woodbridge—On Linear Drawing, by Walter R. Johnson—On Arithmetic, by Warren Colburn—On Classical Learning, by Cornelius C. Felton—On the Construction and Furnishing of School Rooms, and on School Apparatus, by William J. Adams.

These lectures were prepared during those hours which are ordinarily given to relaxation, by gentlemen engaged in the arduous business of teaching. There is, of course, much variety of style, as well as diversity of subject, but they are all highly practical in their tendency; and the teacher who can rise from the perusal of them without having increased his stock of information, must have commenced the task with his measure of capacity already filled, or altogether incapable of retention.

It is not to teachers alone that the work addresses itself. The admirable lecture of Dr. Warren on Physical Education, and indeed several of the others, afford useful lessons to every one engaged in forming the moral and physical habits of the rising generation.

The Working Man's Companion, Part 1.—*The Results of Machinery, namely, Cheap Production, and Increased Employment, exhibited, being an Address to the Working Men of the United Kingdom.*—Philadelphia, republished by Carey and Hart, 18mo. pp. 216, 37½ cents.

We have recently published large extracts from this very excellent production, and our readers, therefore, have had an opportunity to form a judgment of its merits. The subject upon which it treats had occupied much of our attention, but we have derived more information from the perusal of this little work, than from all our previous inquiries, and we recommend the reading of it to every one interested in the progress of the mechanic arts—and who is not?

The Working Man's Companion will consist of a series of works; which will be published in a neat manner, and at a very low price.

The American Library of Useful Knowledge. Published by authority of the Boston Society for the Diffusion of Useful Knowledge, Vol. 1. Boston, 12mo. pp. 320, 75 cents.

This, like the preceding work, is to be continued by the occasional publication of other volumes, intended to form a well assorted

popular library; consisting, in part, of original productions, and in part of a reprint of the most meritorious of those which appear in England.

The present volume comprises a Discourse delivered by Judge Story before the Boston Mechanics' Institution—A Lecture delivered before the same Institution, by the Hon. Daniel Webster—An Essay on the importance to Practical Men, of Scientific Knowledge, and on the Encouragements to its pursuits, by the Hon. Edward Everett—A Lecture to the Working Men's Party, by the same—Dissertation on the Objects, Advantages, and Pleasures of Science, by Lord Chancellor Brougham—An account of Lord Bacon's Novum Oraganon Scientarium, or New Method of Studying the Sciences—A Discourse on the Nature and Advantages of the Study of the Physical Sciences, Part 1, by J. F. W. Herschell, Esq.

This is a neat, compact, and highly valuable volume. The names and talents of the writers of the respective pieces are so well known, that any commendation from us would not be merely superfluous, but might justly be considered as a mark of vanity. If its diffusion be commensurate with its merits, there are few volumes which will be more generally read.

New Conversations on Chemistry, adapted to the present state of that Science; wherein its elements are clearly and familiarly explained; with one hundred and eighteen engravings, illustrative of the subject: Appropriate Questions; a List of Experiments, and a Glossary. On the foundation of Mr. Marcet's "Conversations on Chemistry." By Thos. P. Jones, M. D. Philadelphia, John Grigg, 12mo. pp. 332, $1 25.

The Editor undertook this work with the design of introducing such improvements in the well known "Conversations on Chemistry," as were rendered necessary by the numerous and great discoveries made in that science, but in the prosecution of this intention he soon found that it would be more easy to produce a book which should be essentially new, than to remodel the original. His great aim has been to furnish a work which should be both comprehensive and familiar. A Conversation on the Steam Engine has been introduced, which, it is hoped, will enable any one who peruses it with attention, to understand the leading principles upon which the action of that instrument depends.

Meteorological Observations for August, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
☾	1	72°	86°	29.94	30.00	72	W. W.	Moderate.		Cloudy—flying clouds.
	2	75	84	.42	29.50	73	SW.	do.		Cloudy—rain in night.
	3	72	84	.70	.86	68	SW.	do.	.12	Clear day.
	4	64	73	.80	.80	60	NW.	do.		Clear—cloudy.
	5	61	76	.78	.80	58½	NW.	do.		Cloudy day.
	6	64	75	.83	.90	55	NW.	do.		Cloudy day.
⊗	7	65	73	.86	.86	64	NE.	do.	.6	Cloudy—rain.
	8	63	65	.86	.80	62	NE.	Gale.	1.12	Cloudy—rain.
	9	70	74	.88	.93	68	NE.	Calm.	1.11	Rain.
	10	70	78	30.10	30.10	70	W.	Light.		Cloudy--clear.
	11	70	78	.10	.5	67	N. SW.	Calm.		Cloudy day.
	12	71	81	.00	29.97	63	SW. NW.	Moderate.		Cloudy—clear.
	13	67	82	.2	30.00	63	NW.	do.		Clear—overcast.
	14	68	83	29.97	29.91		W.	do.		Clear day.
☽	15	71	86	.86	.75	69	NW.	do.		Clear day.
	16	73	87	.87	.87	70	W.	do.		Clear day.
	17	75	85	.90	.90	70	W.	do.		Clear day.
	18	75	87	.96	.96	70	SW.	do.	.10	Clear day.
	19	73	86	.96	30.00	70	W.	Calm.		Clear day.
	20	74	84	.96	29.96	70	SW.	Breeze.		Clear day.
	21	75	85	.90	.90	69	SW.	do.		Clear day.
	22	75	86	.86	.86	69	SW.	do.	.26	Cloudy—clear.
☉	23	75	84	.86	.90	70	SW.	Moderate.		Cloudy—clear.
	24	68	87	30.00	30.03	70	SW.	Calm.	.75	Cloudy day.
	25	72	78	.3	.3	72	W.	do.	.70	Drizzling—cloudy.
	26	74	84	30.00	29.90	73	S.	Moderate.	.5	Cloudy—showery.
	27	71	72	29.86	.87	68	NW.	Calm.	.40	Drizzling—showery.
	28	63	72	.90	30.03	48	NW.	Breeze.		Clear day.
	29	57	70	30.14	30.14	47	NE.	Moderate.		Clear day.
	30	60	76	.13	30.00	46	W.	do.		Clear day.
	31	61	76	.3	30.00	59	NE.	do.		Clear—overcast.
	Mean	69.16	79.90	29.91	29.92	65.1			4.67	

	Thermometer.	Barometer.
Maximum height during the month,	87. on 16th, 18th & 24th.	30.14 on 29th.
Minimum do. . .	57. on 29th.	29.42 on 2nd.
Mean do. . .	74.53 . . .	29.90

ERRATA.

The following references to the wood cut of Smith's revolving plane should have been inserted at page 162.

A, Belt wheel used by hand power on small machines—the belt passing over the pulley which is placed upon the axis of the plane wheel.

B, The plane wheel, into which the irons are fixed in such shape and number as the work requires.

C, The piece of timber to be planed or wrought upon, which is placed upon the carriage and secured by dogs or holdfasts.

D, The carriage moved by a rack of iron attached to the bottom part.

E, The cog wheel that moves the carriage.

F, The dogs or holdfasts.

G, The pulleys, of different sizes, placed upon an axis that moves the pinion wheel forward—and backward, by a cross band.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

OCTOBER, 1831.

Description of an economical and delicate Balance; invented by WM. RITCHIE, *F. R. S. Communicated by* D. STROBEL, *Esq., Civil Engineer.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

SIR,—An economical, and at the same time very delicate, balance, for the determination of specific gravities, and the prosecution of chemical investigation in general, has hitherto, I believe, been deemed a desideratum;—under this impression, I send you the description of one, possessing these advantages in an eminent degree, and which, I have little doubt, will prove acceptable, if not useful, to many of your readers.

The instrument I am about to describe is the contrivance of a very learned and talented scientific gentleman, Mr. William Ritchie, M. A. F. R. S., whose acquaintance I had the pleasure to make, at Paris, in the year 1826, and is one amongst many other highly ingenious inventions of his, which he was kind enough to communicate to me.

The annexed sketch represents one of these balances—A, B, Fig. 1, is the beam, which is made of two slender pieces of any light sort of wood, sprung together at each end, and kept asunder in the middle by means of a wooden piece, C. These three pieces are to be well glued or otherwise securely fastened to each other. Through the end of each arm of the beam, and also through the centre of the piece C, is to be driven tight a small piece of hardened steel, formed like the straight part of an ordinary penknife blade, and of a length

sufficient to project on each side one-quarter or one-third of an inch. These blades, or knife edges, are to be fixed, as nearly as may be, equidistant from the centre, though any great nicety in this adjustment is quite unimportant, as we shall see presently. The edges of the blades should be situated nearly in the same horizontal plane, and must be elevated a little above the centre of gravity of the beam, for reasons which are too well known to be repeated here. The fulcrum of the balance rests upon two pieces of thermometer tube, each about half an inch in length, and drawn out in the flame of a lamp so as to reduce their diameter in the middle as shown at Fig. 2. These bits of tube are cemented with sealing wax into two grooves sunk in each side of a forked piece of wood, (see Fig. 3,) forming the upper extremity of a column, which serves as a stand for the instrument. The scale hooks are also formed of thermometer tube, and are represented at Fig. 4. Fig. 5 shows one of the knife edges.

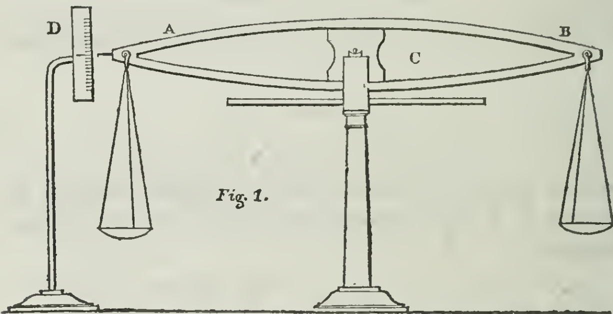
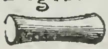


Fig. 1.

Fig. 2.


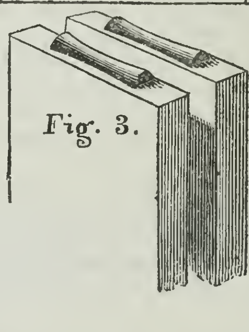
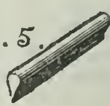


Fig. 3.


Fig. 4.

Fig. 5.


In using this balance for taking the specific gravity of bodies, or for any other purpose, we must always operate in the manner first pointed out, (if I recollect rightly,) by the Chevalier Borda; that is, the substance to be weighed is to be put into one of the scale pans and accurately counterpoised by means of small shot, metallic filings, &c. contained in the other; when this has been effected, the substance is to be removed from the scale, and its place supplied by known weights which are added until an equilibrium is obtained. By

operating in this manner, that perfect equality in the two arms of the lever, (so difficult to arrive at in practice,) becomes evidently of no moment, as has already been remarked in describing the instrument.

From the exceeding lightness of the beam, and the very small extent of touching surface between the knife edges and their glass supports at the points of contact, it will readily be conceded that the friction must necessarily be less than in balances of the ordinary construction; its accuracy will be therefore superior, whilst it may probably be constructed, in most places, for the hundredth part of their cost.

In conclusion, it will perhaps be proper to observe, that in operating with this instrument, when it has been properly adjusted, it will be found to vibrate for a very considerable time before coming to rest; an additional proof of its great delicacy, but which, on most occasions, would be found rather tedious: to obviate this inconvenience, the ingenious inventor inserted in the end, A, of the beam, (Fig. 1,) a common sewing needle, which, when the beam was in a horizontal position, pointed towards the middle of a small piece of pasteboard, D, whereon was traced a number of equi-distant lines, the spaces between which, for distinction sake, I shall call *degrees:* The middle division was marked zero, and the others 1, 2, 3, &c., increasing from zero both upwards and downwards. This piece of pasteboard was affixed to a small stand, as shown in the drawing. The following is Mr. Ritchie's method of using this apparatus; after the substance has been counterpoised, the beam must be suffered to vibrate, and the number of degrees through which the needle passes, both above and below zero, be noted; we must then remove the substance and substitute weights in its stead, until the needle vibrates between the identical divisions it previously did; by this means we get rid of the inconvenience above alluded to, and arrive at results equally accurate with those we should have obtained by suffering the beam to come to rest.

I am, sir, very respectfully,
Your most obedient servant,
D. STROBEL, Jr.
New York, September 1st, 1831. *Engineer.*

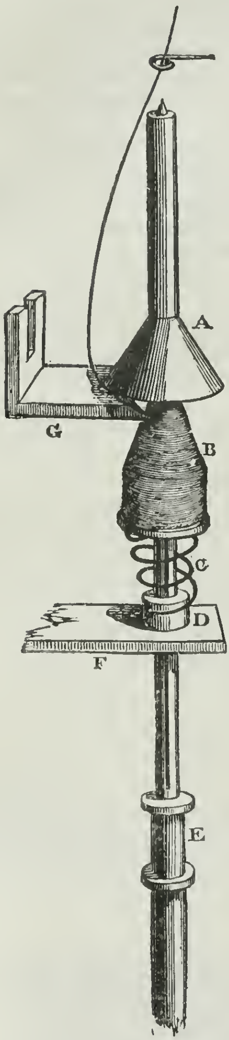
Note.—One of the above described balances was compared, in the laboratory of Gay Lussac, with those made by the most eminent workmen, and was found to equal them in sensibility and accuracy. —EDITOR.

A description of Thorp's improved Running Cap Spinner, with a drawing showing its proper construction for spinning into a shuttle bobbin. Published by request of the patentee.

AT page 388, vol. vi. we inserted a specification of a patent for improvements on the running cap spinner, accompanied by drawings. It was the design of Mr. Thorp to have had an engraving of the spindle as now presented, on the plate which accompanied his specification, but the drawing was not received until too late for the

engraver: we have therefore had the present cut made to remedy this omission.

Thorp's Running Cap Spinner.



A, is a tunnel formed of sheet iron, brass, tin, or any other suitable substance. Its nosle is generally made of an equal diameter throughout, although this is not absolutely necessary. The cavity of said nosle ought to be no longer than is sufficient to allow the body of the bobbin to traverse up into it without interference.

It is supported at the top of the spindle by a conical socket which suits the taper of the spindle, and is held down to its place by a pin which passes entirely through said nosle, occupying a part of its conical hollow. One side of the tapered part of the spindle is scarfed off so as to allow the pin and nosle to go down to a proper bearing, and is there held by an oblique or horizontal notch, which is formed in one side of said scarf level, with the pin, and in which the pin hitches. The diameter of the brim of the tunnel should be considerably larger than that of the bobbin or roll of yarn, so as to admit the check within the brim, without interfering with the bobbin or yarn. B, is the roll of yarn on the bobbin. C is a conical spiral spring used for the purpose of allowing the bobbin to be pressed down when piercing the yarn. The upper end of this spring is confined to a thin plate of sheet iron, brass, or tin. Said plate is a small size larger than the head or base of the bobbin, so as to be taken hold of without interfering with the bobbin. This plate is perforated in the centre, and loosely encompasses the spindle. It has a tube extending up into the bobbin a short distance, or it may be made dishing, so that the base of the bobbin which sets on it, will find a sufficient friction from which to receive motion. In case of piercing the yarn when the bobbin is at its highest elevation, the plate is taken hold of and pressed down for that purpose. The lower end of the spring is confined to the thimble D, which thimble supplies the place of the collar described in the former publication, to which reference may be had. E, is the box that forms the upper bearing of the spindle. G, the check. F, the lifter on which the above named thimble sets.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, *to ascertain, by experiment, the value of Water as a Moving Power.*

(Continued from p. 153.)

TABLE G.—PART I.

CHUTE NO. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Top of Bkt.	Btm. of Bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	9.34	11.27	12.56	0.50	463	48.05	511.05	41.5	30	13.02	2350	23.00	540500	212085	.392			
2					669	51.61	720.61		33	11.84	2820		648600	299053	.460			
3					772	53.39	825.39		35	11.16	3100		713000	342536	.480			
4					875	55.17	930.17		44	9.88	3475		799250	386020	.484			
5					978	56.95	1034.95		45	8.70	3770		867100	429504	.494	.494	8.70	
6					1081	58.73	1139.73		52	7.52	4200		966000	472987	.489			
7					1184	60.51	1244.51		56	6.98	4700		1081000	516471	.477			
8					1287	64.88	1351.88		63	6.20	5200		1196000	561030	.469			
9					1390	69.25	1459.25		63	6.20	5640		1297200	605588	.466			
10					1493	73.62	1566.62		65	6.01	6000		1380000	650146	.471			
11					1596	77.99	1673.99		69	5.66	6425		1477750	694705	.463			
2					1699	82.36	1781.36		80	4.88	7200		1656000	739263	.447			
13	9.34	11.27	12.56	0.75	772	53.39	825.39	41.5	27	14.48	3325	23.00	764750	342536	.447			
14					875	55.17	930.17		30	13.02	3525		810750	386020	.475			
15					978	56.95	1034.95		33	11.84	3850		885500	429504	.487			
16					1081	58.73	1139.73		35	11.16	4075		937250	472987	.504			
17					1184	60.51	1244.51		40	9.77	4425		1017750	516471	.507			
18					1287	64.88	1357.88		41	9.54	4780		1099400	561030	.510			
19					1390	69.25	1459.25		44	8.88	5140		1182200	605588	.512	.512	8.88	
20					1493	73.62	1566.62		47	8.32	5585		1284550	650146	.505			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE G.—PART II.

CHUTE NO. 3.—*Elbow buckets. Close-breast. Bottom of gate 13.66 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wtofwater expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	9.34	11.27	12.56	0.75	1596	77.99	1673.99	41.5	53	7.38	6100	23.00	1403000	694705	.495			
22					1699	82.36	1781.36		56	6.98	6575		1512250	739263	.488			
23					1802	86.73	1888.73		57	6.86	7100		1633000	783823	.485			
24					1905	91.10	1996.10		63	6.20	7520		1729600	828381	.472			
25					2008	95.47	2103.47		68	5.76	8100		1863000	872939	.467			
26					2111	99.84	2210.84		73	5.35	8625		1983750	917498	.456			
27					2214	104.21	2318.21		80	4.88	9375		2156250	962056	.446			
28	7.09	9.02	10.31	0.50	463	48.05	511.05	41.5	30	13.02	2400	20.75	498000	212085	.425			
29					566	49.83	615.83		32	12.20	2670		554025	255569	.461			
30					669	51.61	720.61		38	10.28	2910		603825	299053	.495			
31					772	53.39	825.39		43	9.09	3220		688150	342536	.509			
32					875	55.17	930.17		47	8.32	3575		741312	386020	.520	.520	8.32	
33					978	56.95	1034.95		56	6.98	4035		837262	429504	.513			
34					1081	58.73	1139.73		63	6.20	4550		944125	472987	.500			
35					1184	60.51	1244.51		67	5.84	5025		1042687	516471	.495			
36					1287	64.88	1351.88		72	5.43	5525		1156437	561030	.485			
37					1390	69.25	1459.25		80	4.88	6100		1265750	605588	.478			
38					1493	73.62	1566.62		90	4.34	6700		1390250	650146	.467			
39					1699	82.36	1781.36		103	3.79	7700		1597750	739263	.462			
40					1905	91.10	1996.10		112	3.49	8860		1838450	828381	.450			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table G.—Part III.

Chute No. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity, per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
41	7.09	9.02	10.31	0.75	978	56.95	1034.95	41.5	36	10.86	3920	20.75	813400	429504	.527			
42					1081	58.73	1139.73		38	10.28	4175		866312	472987	.546			
43					1184	60.51	1244.51		41	9.53	4530		939975	516471	.549	.549	9.53	
44					1287	64.88	1351.88		46	8.50	4975		1032312	561030	.543			
45					1390	69.25	1459.25		50	7.82	5475		1136062	605588	.533			
46					1493	73.62	1566.62		53	7.37	5975		1239813	650146	.524			
47					1596	77.99	1673.99		58	6.73	6400		1328000	694705	.523			
48					1699	82.36	1781.36		60	6.51	6930		1438975	739263	.513			
49					1802	86.73	1888.73		67	5.83	7450		1545875	783823	.506			
50					1905	91.10	1996.10		74	5.28	8050		1670375	828381	.495			
51					2008	95.47	2103.47		82	4.77	8700		1805250	872939	.483			
52					2111	99.84	2210.84		86	4.54	9228		1914187	917498	.479			
53	7.09	9.02	10.31	1.00	1081	58.73	1139.73	41.5	31	12.60	4350	20.75	902625	472987	.527			
54					1184	60.51	1244.51		32	11.84	4650		964870	516471	.535			
55					1287	64.88	1351.88		36	10.86	5000		1037500	561030	.541			
56					1390	69.25	1459.25		38	10.28	5350		1110125	605588	.545			
57					1493	73.62	1566.62		40	9.77	5675		1177562	650146	.551			
58					1596	77.99	1673.99		43	9.09	6025		1250187	694705	.555	.555	9.09	
59					1699	82.36	1781.36		45	8.69	6475		1343562	739263	.550			
60					1802	86.73	1888.73		51	7.66	7000		1452500	783823	.539			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table G.—Part IV.

Chute No. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
61	4.09	6.02	7.31	0.50	566	49.83	615.83	41.5	40	9.77	2775	17.75	481687	255569	.530			
62					772	53.39	825.39		53	7.38	3475		616812	342536	.555	.555	7.38	
63					875	55.17	930.17		63	6.20	3975		705562	386020	.546			
64					978	56.95	1034.95		70	5.58	4460		791650	429504	.542			
65					1081	58.73	1139.73		75	5.21	4900		869750	472987	.543			
66					1184	60.51	1244.51		83	4.71	5400		958500	516471	.539			
67					1287	64.88	1351.88		100	3.91	6025		1069437	561030	.524			
68					1390	69.25	1459.25		102	3.83	6550		1162625	605588	.524			
69					1493	73.62	1566.62		109	3.59	7025		1246937	650146	.521			
70	4.09	6.02	7.31	0.75	669	51.61	720.61	41.5	37	10.56	3150	17.75	559125	299053	.534			
71					772	53.39	825.39		39	10.02	3450		612375	342536	.559			
72					875	55.17	930.17		42	9.31	3725		661187	386020	.584			
73					978	56.95	1034.95		45	8.70	4075		723312	429504	.593			
74					1081	58.73	1139.73		51	7.66	4450		789875	472987	.598			
75					1184	60.51	1244.51		51	7.66	4800		852000	516471	.606	.606	7.66	
76					1287	64.88	1351.88		62	6.30	5350		949625	561030	.590			
77					1390	69.25	1459.25		65	6.00	5800		1029500	605588	.588			
78					1493	73.62	1566.62		73	5.35	6400		1136000	650146	.574			
79					1596	77.99	1673.99		77	5.07	6950		1233625	694705	.562			
80					1699	82.36	1781.36		83	4.71	7500		1331250	739263	.555			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE G.—PART V.

CHUTE NO. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Seds.	Feet.	Pds.	Feet.						
81	4.09	6.02	7.31	1.00	875	55.17	930.17	41.5	36	10.86	3800	17.75	674500	386020	.572			
82					978	56.95	1034.95		38	10.28	4125		732187	429504	.586			
83					1081	58.73	1139.73		42	9.31	4500		798750	472987	.591			
84					1184	60.51	1244.51		43	9.09	4825		856437	516471	.603			
85					1287	64.88	1351.88		47	8.32	5225		927437	561030	.605	.605	8.32	
86					1390	69.25	1459.25		52	7.52	5700		1011750	605588	.598			
87					1493	73.62	1566.62		57	6.85	6225		1104937	650147	.588			
88					1596	77.99	1673.99		60	6.50	6650		1180375	694705	.588			
89					1802	86.73	1888.73		71	5.50	7725		1371187	783822	.571			
90					2008	95.47	2103.47		82	4.77	8900		1579750	872939	.552			
91	1.09	3.02	4.31	0.75	566	49.83	615.83	41.5	49	7.98	2850	14.75	420375	255569	.608			
92					669	51.61	720.61		62	6.30	3250		479375	299053	.624			
93					772	53.39	825.39		64	6.10	3650		538375	342536	.636	.636	6.10	
94					875	55.17	930.17		73	5.35	4150		612125	386020	.630			
95					978	56.95	1034.95		81	4.83	4650		685875	429504	.626			
96					1081	58.73	1139.73		87	4.49	5175		763312	472987	.619			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE G.—PART VI.

CHUTE No. 3.—*Elbow buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
97	1.09	3.02	4.31	1.00	772	53.39	825.39	41.5	51	7.66	3675	14.75	542062	342536	.631			
98					875	55.17	930.17		61	6.40	4100		604750	386020	.638			
99					978	56.95	1034.95		62	6.30	4500		663750	429504	.647	.647	6.30	
100					1081	58.73	1139.73		70	5.58	5000		737500	472987	.641			
101					1184	60.51	1244.51		81	4.83	5500		811250	516471	.636			
102					1287	64.88	1351.88		88	4.44	6000		885000	561030	.633			
103					1390	69.25	1459.25		90	4.35	6500		958750	605588	.631			
104	1.09	3.02	4.31	1.25	1081	58.73	1139.73	41.5	60	6.50	4900	14.75	722750	472987	.654			
105					1184	60.51	1244.51		63	6.20	5325		785437	516471	.657			
106					1287	64.88	1351.88		69	5.66	5775		851812	561030	.658	.658	5.66	
107					1390	69.25	1459.25		74	5.28	6325		932937	605588	.649			
108					1493	73.62	1566.62		82	4.77	6875		1014062	650147	.641			
109					1596	77.99	1673.99		90	4.35	7375		1087812	694705	.641			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table H.—Part I.

[Chute No. 3.—*Centre buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	9.34	11.27	12.56	0.50	669	51.61	720.61	41.5	39	10.02	3000	23.00	690000	299053	.433			
2					772	53.39	825.39		42	9.31	3275		753250	342536	.454			
3					875	55.17	930.17		46	8.50	3625		833750	386020	.462	.462	8.50	
4					978	56.95	1034.95		49	7.98	4085		939550	429504	.457			
5	9.34	11.27	12.56	0.75	669	51.61	720.61	41.5	27	14.48	3200	23.00	736000	299053	.406			
6					875	55.17	930.17		34	11.50	3625		833750	386020	.462			
7					1081	58.73	1139.73		36	10.86	4250		977500	472987	.484	.484	10.86	
8					1184	60.51	1244.51		41	9.54	4650		1069500	516471	.483			
9					1287	64.88	1351.88		45	8.71	5075		1167250	561030	.480			
10					1390	69.25	1459.25		50	7.82	5600		1288000	605588	.470			
11					1493	73.62	1566.62		60	6.50	6235		1434050	650146	.453			
12	9.34	11.27	12.56	1.00	1493	73.62	1566.62	41.5	40	9.77	5575	23.00	1282250	650147	.507	.507	9.77	
13					1596	77.99	1673.99		42	9.31	6050		1391500	694705	.499			
14	7.09	9.02	10.31	0.50	566	49.83	615.83	41.5	40	9.77	2800	20.75	581000	255569	.436			
15					669	51.61	720.61		43	9.09	3125		648437	299053	.451			
16					772	53.39	825.39		48	8.14	3475		721062	342536	.475	.475	8.14	
17					875	55.17	930.17		56	6.98	3930		815475	386020	.472			
18					978	56.95	1034.95		61	6.40	4400		913000	429504	.470			
19					1081	58.73	1139.73		69	6.66	4900		1016750	472987	.465			
20					1184	60.51	1244.51		75	5.21	5535		1148512	516471	.449			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE H.—PART II.

CHUTE NO. 3.—*Centre buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	7.09	9.02	10.31	0.75	875	55.17	930.17	41.5	36	10.86	3800	20.75	788500	386020	.489			
22					978	56.95	1034.95		38	10.28	4110		852825	429504	.503			
23					1081	58.73	1139.73		43	9.09	4500		933750	472987	.506	.506	9.09	
24					1184	60.51	1244.51		51	7.66	4975		1032312	516471	.500			
25					1287	64.88	1351.88		63	6.20	5725		1187937	561030	.472			
26	7.09	9.02	10.31	1.00	1081	58.73	1139.73	41.5	35	11.16	4435	20.75	920262	472987	.514			
27					1184	60.51	1244.51		39	10.02	4800		996000	516471	.518			
28					1287	64.88	1351.88		43	9.09	5225		1084187	561030	.517			
29					1390	69.25	1459.25		46	8.50	5575		1156812	605588	.523	.523	8.50	
30					1493	73.62	1566.62		50	7.82	6225		1291687	650147	.503			
31					1596	77.99	1673.99		56	6.98	6725		1395437	694705	.498			
32	4.09	6.02	7.31	0.75	978	56.95	1034.95	41.5	50	7.82	4425	17.75	785437	429504	.547	.547	7.82	
33					1081	58.73	1139.73		54	7.23	4895		868862	472987	.542			
34					1184	60.51	1244.51		66	5.92	5475		971812	516471	.531			
35					1287	64.88	1351.88		73	5.35	6125		1087187	561030	.516			
36					1390	69.25	1459.25		78	5.01	6675		1184812	605588	.511			
37	4.09	6.02	7.31	1.00	1081	58.73	1139.73	41.5	45	8.69	4710	17.75	836025	472987	.561			
38					1184	60.51	1244.51		50	7.82	5125		909687	516471	.567	.567	7.82	
39					1287	64.88	1351.88		52	7.51	5600		994000	561030	.564			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE H.—PART III.

CHUTE No. 3.—*Centre buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Head of Water above. Top of bkt.	Head of Water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
40	1.09	3.02	4.31	1.00	669	51.61	720.61	41.5	54	7.23	3600	14.75	531000	299053	.563			
41					772	53.39	825.39		63	6.20	4025		593687	342536	.576			
42					875	55.17	930.17		69	5.66	4450		656375	386020	.588	.588	5.66	
43					978	56.95	1034.95		77	5.07	4950		730125	429504	.588			
44					1081	58.73	1139.73		88	4.44	5500		811250	472987	.583			
45					1184	60.51	1244.51		92	4.24	6025		888678	516471	.581			
46	1.09	3.02	4.31	1.25	978	56.95	1034.95	41.5	44	8.88	4975	14.75	733812	429504	.585			
47					1081	58.73	1139.73		49	7.98	5435		801662	472987	.589			
48					1184	60.51	1244.51		52	7.51	5835		860662	516471	.600			
49					1287	64.88	1351.88		56	6.98	6275		925562	561030	.606			
50					1390	69.25	1459.25		62	6.30	6750		995625	605588	.607			
51					1493	73.62	1566.62		66	5.92	7250		1069375	650147	.608			
52					1596	77.99	1673.99		68	5.75	7625		1124687	694705	.617	.617	5.75	
53					1699	82.36	1781.36		71	5.50	8125		1198437	739263	.616			
54					1802	86.73	1888.73		80	4.88	8750		1290625	783822	.607			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE H.—PART IV.

CHUTE NO. 3.—*Centre buckets. Close breast. Bottom of gate* 13.66 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
55	1.09	3.02	4.31	1.50	1596	77.99	1673.99	41.5	64	6.10	7600	14.75	1121000	694705	.619			
56					1699	82.36	1781.36		66	5.92	8050		1187375	739263	.624			
57					1802	86.73	1888.73		69	5.66	8475		1250062	783822	.627	.627	5.66	
58					1905	91.10	1996.10		74	5.28	9025		1331187	828381	.622			
59					2008	95.47	2103.47		79	4.95	9725		1434437	872939	.608			
60	1.09	3.02	4.31	1.75	1699	82.36	1781.36	41.5	59	6.62	8030	14.75	1184425	739263	.624			
61					1802	86.73	1888.73		64	6.10	8460		1247850	783822	.628	.628	6.10	
62					1905	91.10	1996.10		67	5.83	9000		1327500	828381	.624			
63					2008	95.47	2103.47		72	5.43	9600		1416000	872939	.616			
64					2111	99.84	2210.84		77	5.07	10330		1523675	917498	.602			
65	4.09	6.02	7.31	1.00	1184	60.51	1244.51	41.5	44	8.88	4925	17.75	874187	516471	.590			
66					1287	44.88	1351.88		47	8.31	5300		940750	561030	.596			
67					1390	69.25	1459.25		51	7.66	5700		1011750	605588	.598	.598	7.66	
68					1493	73.62	1566.62		56	6.98	6160		1093400	650147	.594			Air vents open.
69					1596	77.99	1673.99		61	6.40	6625		1175937	694705	.590			
70					1802	86.73	1888.73		69	5.66	7650		1357875	783822	.577			
71					2008	95.47	2103.47		90	4.34	8650		1535375	872939	.568			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

(TO BE CONTINUED.)

Proposed plan for Smelting Iron Ore with Anthracite Coal.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The annexed communication was received from an unknown correspondent, and we have concluded to insert it in our journal, as it relates to a subject which we deem of the highest importance; we are not disposed to place much reliance, *a priori*, upon the value of his suggestions, as some of them are new and untried; but we are open to conviction as to their utility;--others we know to be erroneous. The writer has, we think, overrated the advantages of the water blast. That it produces a cheap and uniform blast is unquestionable, but the air which issues from it is so saturated with moisture as to occasion an increased expenditure of fuel, which more than counterbalances any advantages resulting from the cheapness and facility of construction, besides occasioning very serious inconveniencies in those furnaces in which the highest temperature is desirable. As to his suggestion of introducing a small jet of steam, we must be permitted to question its advantages; the experiment was tried many years since, in England, and failed. See Jour. Arts and Manuf. iv. 235, quoted in Hassenfratz's Siderotechnie, ii. 130. We invite the attention of our readers and correspondents to the importance of devising a mode of applying anthracite to the smelting of iron ore.

Com. Pub.

On the top of a reverberatory furnace, build a vertical furnace, with its lower extremity, or crucible, connected with the lower furnace, in such a manner that the hearth of the lower furnace shall serve for the hearth of the upper furnace also. The shape of the upper furnace may be similar to the common blast furnace, and its height about the same as the length of the lower furnace. The top of the upper furnace must not be open like the common blast furnace, but covered, and connected by a flue to the chimney of the lower furnace.

There must be an opening near the top of the upper furnace, for the introduction of the coal and ore, which must be kept closed, so that no air can enter, only through openings made for that purpose near the bottom of the furnace, in order to supply air for combustion. The flues of the furnaces must be connected and turned horizontally and inserted into a water blast, or *trompe*, (for the manner of constructing which, see Rees' Cyclopædia--article, water-bellows; and also in the Chemistry of the Arts, published by Porter, 1830, p. 57 and 58, there is an account given of its producing a very powerful draught of air through a furnace.) The reverberatory furnace must first be raised to a sufficient degree of heat; then the upper furnace charged with coal and ore: as the one melts it drops from the crucible of the upper furnace into the hearth of the lower furnace, where it will be kept fluid, until sufficient is collected to be drawn off. It is believed that a sufficient flame may be produced from anthracite coal to heat the reverberatory furnace, by introducing a small jet of

steam, as has been done by the Messrs. Wetherells, of Philadelphia. If bituminous coal were used in the lower furnace, it would probably not affect the quality of the iron, as it would be always covered with fluid cinders.

The author of these suggestions melted iron ore very easily, in a small air furnace with anthracite coal, the only difficulty met with was, that the metal chilled on the hearth of the furnace. If, in this experiment, there had been means of keeping the melted metal fluid, the ore might have been smelted very fast, on a small scale, as there was no difficulty in keeping up a sufficient degree of heat to melt the ore in the furnace, above the *tuyere*, or opening, for the ingress of the air. The result of this experiment, and a knowledge of the fact, that a very powerful air draught may be obtained by the mode above referred to, (viz. the water-draught,) and a belief that a blast given by bellows is not so conducive to the rapid combustion of anthracite coal, as a more uniform and general blast, has induced me to make these suggestions to those who feel a sufficient interest to make experiments, in order to accomplish so important an object.

A. B.

Lebanon, Penn., August, 1831.

On Blasting Rocks. By Robert Hare, *M. D., Professor of Chemistry in the University of Pennsylvania.*

An account has lately been published of the death of a workman, near Norristown, dreadfully bruised, and lacerated, by the blasting of a rock. I have ascertained that the process for blasting rocks may be rendered safer than the firing of a fowling piece, by a new application of galvanism. I was led to make this improvement in consequence of an application by a patentee, (Mr. Moses Shaw,) for assistance in perfecting his patented mode of blasting rocks by an electric discharge from a Leyden Jar.

In a letter dated June 1st, 1831, he says, "I have been engaged in blasting rocks by means of a fulminating powder, introduced into several cavities, and ignited in all of them simultaneously, by a spark from an electrical machine, by which means masses of a much larger size, and of a much more suitable shape, for any object in view, may be procured, than by the old plan. I have, however, to lament my inability to succeed in this method of blasting during a great part of the year, when, in consequence of the unfavourable state of the weather, the ignition cannot be effected by electricity in any mode which I have devised, or which has been suggested by others, although I have consulted all the best informed professors to whom I have had access."

It occurred to me as soon as this statement had been made by Mr. Shaw, that the ignition of gunpowder, for the purposes he had in view, might be effected by a galvanic discharge from a deflagrator, or calorimotor, in a mode which I have long used in my eudiometrical experiments to ignite explosive gaseous mixtures. This process is free

from the uncertainty which is always more or less attendant upon the employment of mechanical electricity for similar purposes.

The expectation thus arising has since been fully verified. I have ignited as many as twelve charges of gunpowder at the distance of one hundred and thirty feet from the galvanic machine employed. This distance is much greater than is necessary to the safety of the operator, as the deflagrator may be shielded so as not to be injured by the explosion, and by means of levers and pulleys, it may be made to act at any distance which may be preferable. There is no limit to the number of charges which may be thus ignited, excepting those assigned, by economy, to the size of the apparatus employed.

These remarks have reference to the principal and highly important object of Mr. Shaw's project, which is, to ignite at once a great number of charges in as many perforations so drilled in a rock as to co-operate simultaneously in the same plan. By these means it is conceived that the stone may be separated into large prismatic or tabular masses, instead of being reduced to irregular fragments of an inferior size. The object to which I propose now to call attention more particularly is, a modification of the common process of blasting by one charge, which renders that process perfectly safe.

This part of the subject I shall introduce by premising that almost all the accidents which have taken place in blasting rocks, have occurred in one of the three following modes:

1st. The explosion has taken place prematurely, before the operator has had time to retire.

2nd. A premature explosion has ensued from a spark produced by the collision arising from ramming into the orifice of the perforation, containing the powder, the brickdust or sand employed to close it.

3d. The fire not reaching the charge after the expiration of a period unusually long, and the operator returning to ascertain the cause of the supposed failure, an explosion ensues when he is so near as to suffer by it, as in the instance near Norristown, lately published.

The means of communicating ignition, to which I have resorted, are as follows:—

Three iron wires, of which one is of the smallest size used for wire gauze, the others of the size, (No. 24,) used by bottlers, are firmly twisted together. This is best accomplished by attaching them to the centre of the mandril of a lathe, which is made to revolve while the other ends of the wires are held by a vice, so as to keep them in a proper state of tension. After being thus twisted, a small portion is untwisted, so as to get at, and divide, the larger wires by means of a pair of nippers. In this way the smaller wire is rendered the sole mean of metallic connexion between the larger ones. These are tied in a saw kerf, so made in a piece of dogwood as to secure them from working, which, if permitted, would cause the smaller wire to break apart. At one end, the twist formed of the wires is soldered to the bottom of a tin tube of a size to fill the perforation in the rock to such a height as may be deemed proper. This tube being supplied with gunpowder, the orifice is closed with a cork, perforated

so that the twisted wire may pass out through it without touching the tube at any point above that where the finer portion alone intervenes. To the outside of the tube a copper wire, about No. 16, is soldered, long enough to extend to a copper, or leaden, rod proceeding from one of the poles of a galvanic deflagrator, or calorimotor. The wire passing through the cork, from the inside of the tube, is in like manner made to communicate with the other pole. The connexions between the wires, rods and poles, should be made by means of soft solder, previously to which we must imagine that the tube has been introduced into a perforation made for its reception in a rock to be blasted. The tin tube may be secured within the rock by the usual method of ramming in brickdust or sand, by means of a punch, having holes for the protection of the wires of communication already described.

The apparatus being thus prepared, by a galvanic discharge, produced by the movement of a lever through a quarter part of a circle, the finer wire is ignited, in the place where it intervenes solely in the circuit, so as to set fire to the surrounding gunpowder.

As the enclosure of the gunpowder in the tube must render it impossible that it should be affected by a spark elicited by ramming, as no means of ignition can have access to the charge besides the galvanic discharge; and as this can only occur by design, with an intention to commit murder or suicide, or from unpardonable neglect, it is inconceivable that an explosion can take place in this method of blasting, when any person is so situated as to suffer by it.

It must be obvious that in all cases of blasting under water, the plan of the tin tube, and ignition by a galvanic circuit must be very eligible.

I hope Mr. Shaw may meet with the patronage which his project merits.

Robt. Hare.

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

The committee appointed to investigate the causes of explosions in steam boilers have had the subject under consideration for some time; and have pursued with as much diligence as possible the course of experiments instituted with a view to shed light on this question. These experiments require much nicety and care; and the members of the committee are all so much occupied in their own private business that the inquiry is necessarily protracted. Some of the results which they have already obtained, they believe to be curious, and they will not fail in due time to lay them before the public. Their present intention is to communicate a portion of the letters which they have received. Although the replies to their circular have not been so numerous and detailed as they might wish, yet the committee have been favoured with many very interesting communica-

tions which they believe it would be an act of injustice to their authors longer to withhold from the public.

Independently of the general information which they are calculated to give, the circulation of these letters may be productive of other advantages. By publishing the opinions of able and intelligent observers, the committee hope to elicit a discussion of them by others. Such a discussion cannot fail to enlighten us still more on the numerous causes of the accidents which have occurred.

The committee, moreover, are under the impression that many acute and intelligent observers have been, from an excess of diffidence as to their talents for writing, induced to suppress their communications. Perhaps, after seeing the nature of the information required, they may feel disposed to contribute their share to the general stock. Facts, plainly and clearly stated, are the most valuable contribution which can be made; and there is scarcely a practical mechanic on our western waters who may not be able to communicate something that has escaped the attention of others. If any letters should come in a form not exactly fitted for publication, the committee would, with the permission of their authors, revise them with that view.

To avoid any appearance of partiality, the committee have determined to publish these letters in the order of their date, but they have been induced occasionally to deviate from this rule, so as to group together such as refer to the same accident. By exhibiting the views of different writers upon the same explosion, in one continued series, it will be easier to come at the truth as to its real cause. Thus, for example, in relation to the Helen M'Gregor and Caledonia, the committee will have the pleasure of presenting, in the next number, several letters which mutually confirm each other.

In order to collect all that bears upon that investigation, the committee are induced to commence their publication with the reprint of a very interesting pamphlet published many years since in this city, but which has now become very scarce. For the copy which is in their possession, the committee are under obligations to Roberts Vaux, Esq. the chairman of the committee of councils to whom this matter was at that time referred.

1. *Report of the Joint Committee appointed by the Select and Common Councils, on the subject of Steam Boats.*

The joint committee of the select and common councils appointed to consider "*whether any, and if any, what, regulations can be enforced in relation to the use of steam, employed in propelling boats for the accommodation of passengers, which arrive at, and depart from, the wharves within the jurisdiction of the corporation:*" and also, (should it be necessary,) "*to prepare a memorial to the legislature of the state, soliciting its interposition, effectually to control the use of steam in passage boats,*" Report:

That, sensible of the importance of the duty assigned them, they have devoted much time and attention to the investigation. They have availed themselves of the learning and experience of scientific

characters, whose prompt, candid, and able illustrations and advice on the subject, are entitled to acknowledgments which the committee take pleasure in rendering for themselves, and on behalf of their constituents.

Convinced by the notorious and afflicting fact, that *human life* had been frequently destroyed in consequence of the bursting of the boilers of steam engines, used in navigating boats, it became a prominent and interesting question with the committee, *whether any, and what effectual mode could be adopted to prevent such explosion.* To the gentlemen previously alluded to, the inquiry was submitted. Their opinion of the necessity of legal interference, with a plan for testing the strength of boilers, and contemplating the attachment to them of safety valves, to be placed beyond the reach of the caprice or temerity of engineers, being furnished, it was with a circular note transmitted to the proprietors of those steam boats which pass upon the Delaware, and accompanies this report, numbered 1.

A disposition to acquiesce in the regulations and precautions, thus suggested, was manifested by the persons to whom they were proposed; but it was alleged by some of them, that their adoption would not provide against *all* the casualties incident to the management of steam engines which might produce explosion. It was represented, that the plan was calculated to give unjustifiable confidence to the public, that thereby the use of *high steam* would be sanctioned, when in fact, the most destructive consequences must inevitably be visited upon every person on board vessels propelled by it, should an accident from any cause whatever happen to a boiler, with which it was charged. And it was furthermore affirmed, that the fracture of boilers containing steam of the pressure ordinarily used in boats, could not subject passengers to injury, inasmuch as such occurrences had frequently taken place, producing no other inconvenience than delay to repair them.

With considerations of this nature the committee could not but be impressed, whether they regarded the responsibility fairly attachable to themselves, in recommending a course for councils to pursue, or anticipated the unhappy and afflicting consequences that might, in the range of probability, occur to those whose reliance for safety should be upon the entire security of the plan proposed.

A new train of reflection being thus excited, the committee were induced again to apply to the gentlemen who had previously aided them with their advice, from whom they solicited the favour of answers to the questions exhibited in the document numbered 2, herewith submitted.

The replies to those inquiries are contained in the communications numbered 3, 4, and 5—now furnished.

Much valuable and important information was derived from those letters, the nature of which has induced the committee to believe, that the use of steam employed in passage boats, is a subject so deeply and extensively interesting to society, as to render municipal enactments inadequate to a complete regulation of those establishments. To the higher authority of the state legislature, they would therefore

earnestly recommend the subject, with a confidence, that its wisdom will devise, and its power enforce, such legal restraints as the object manifestly requires.

With this view, they respectfully submit the propriety of collecting further facts, to accompany a memorial to the Senate and House of Representatives of the commonwealth of Pennsylvania at its ensuing session.

ROBERTS VAUX,
WM. SMITH,
WILLIAM LEHMAN,
HOR. BINNEY,
GEO. VAUX.

Philadelphia, July 14, 1817.

(No. 1.)

(CIRCULAR.)

The unhappy consequences which have resulted from the explosion of the boilers of steam engines, employed in propelling boats for the accommodation of travellers, has excited serious and just apprehensions in the public mind, prejudicial to the interests of those valuable establishments, and requiring the interposition of such as are intrusted with the guardianship of the common welfare. Under impressions of this character, the select and common councils of the city of Philadelphia, appointed a joint committee to inquire what regulations ought to be enforced, in relation to the use of steam, so far as their authority might extend to vessels navigated by that agent, which arrive at, and depart from, the wharves, within the jurisdiction of the corporation. That committee anxious to learn from disinterested persons, of unquestionable scientific knowledge, what mode could be adopted to render the boilers of steam boats perfectly safe, addressed a letter to Professor Cooper, Joseph Cloud, Jacob Perkins, and Frederick Graff, in answer to which those gentlemen have furnished the opinions herewith exhibited. Previously, however, to the adoption of any measures, predicated upon this report, it was conceived to be most respectful to submit it to the proprietors of steam boats. I comply, therefore, with the directions of the committee, in transmitting this circular, with a request that on, or before, the 25th instant, information may be communicated, whether the plan proposed will be acceded to by those interested, or not.

Very respectfully,

ROBERTS VAUX,

Chairman of the Committee of Select and Common Councils

Philadelphia, 6 mo. (June) 12, 1817.

To ROBERTS VAUX, Esq.

Chairman of a Joint Committee of the Select and common Councils of the city of Philadelphia.

The committee to whom was referred the question, "*whether any, and what effectual mode can be adopted, to render the boilers of steam*

engines employed in propelling boats, free from the danger of explosion," having met, and jointly considered the subject, are of opinion,

That, for the purpose of preserving the credit, and securing to the public the benefit of conveyance by means of steam boats, some regulations are absolutely necessary, and may be adopted without injury to the owners of vessels so navigated, whose interest ought to coincide in this respect with the interest of the public.

That two improvements are very desirable: if adopted, would prove sufficient to ensure the safety of the passengers from the dreadful accidents which have lately taken place, by the bursting of boilers, and the explosion of steam strongly heated: these are,

First, to adopt and enforce the following regulations, viz. allowing every captain or owner to navigate his vessel with steam raised to whatever temperature he thinks most expedient for his own purposes, he should be compelled to permit inspectors, appointed by law, once in every month, to prove the strength of his boilers, by loading them for the purpose of ascertaining their strength; first, with double, and afterwards with once and a half the force of the steam he proposes permanently to use, by filling them with water, and loading a pipe with the weight necessary to give to the boiler the required pressure. This can be conveniently managed by pressure on Bramah's principle, and need not occupy an hour's time. Thus, if the captain proposes to work with steam pressing with a force of ten pounds on the square inch, let the boiler be tried with a pressure of twenty pounds on the square inch; and then with a force of fifteen pounds per square inch. If it stands this trial, it may reasonably be presumed to bear the required pressure of ten pounds per square inch, until the next monthly period of trial appointed by law. To make it sure that the engine shall not be worked in any intermediate time, by means of steam affording a higher pressure than that required, let a separate safety valve be provided, and kept locked up in a box connected with the steam engine apparatus, of which box the inspector appointed by law ought to be permitted and required to keep the key, which box should not be opened till the next period of inspection. This safety valve should be regulated to the pressure required, and at which the steam engine is to be actually worked. So that however high the common exposed safety valve may be loaded by those who work the engine, the safety valve, locked up, shall effectually prevent the use of any higher pressure than that permitted.

A *second* improvement would be, to separate the steam engine apparatus by strong partitions erected between this and the part of the vessel occupied by the passengers: which partitions should be so constructed as to be decidedly the strongest part exposed to explosion, should such an event take place. Hence the planking of the sides of the vessel near to the steam engine apparatus, and the part of the deck that covers it, should be purposely made somewhat weaker than the partitions, and more liable to be torn or blown away by an explosion, which in such case could not affect the passengers.

The committee beg leave to observe, that such trials of the strength

of boilers are on the same principle with the acknowledged necessity of trying the strength and resistance of all kinds of fire arms: and that the periodical repetition of these trials is made necessary by the unavoidable wear and tear of the machinery to which a steam engine is exposed.

The second improvement is suggested from the common practice of gunpowder makers, who are also liable to dangerous explosions, and who make those sides of their rooms weak, where an explosion can do the least damage when forced by the strength of the other sides to take that direction.

The committee further observe, that the boilers of the steam engine should be made of sheet and not of cast iron, which in case of explosion is much more dangerous from its fragments than sheet iron. But if the improvements now suggested by the committee should be adopted, it is hardly possible for an explosion to happen at all, or, if it should happen, to prove dangerous in any degree to the passengers in the vessel.

Those owners of steam boats who are willing to submit to the proposed regulations, ought to be strongly recommended to the public in preference to others: but the sense of safety that a passenger will feel in consequence of these improvements being adopted, will be of itself a sufficient recommendation of those boats wherein they are adopted. All which is respectfully submitted.

THOMAS COOPER,
JOSEPH CLOUD,
JACOB PERKINS,
FREDERICK GRAFF.

Philadelphia, June 11, 1817.

(No. 2.)

Thomas Cooper, Joseph Cloud, Jacob Perkins, and Frederick Graff, Esquires.

I am directed by the joint committee of the select and common councils of the city of Philadelphia, appointed on the subject of steam boats, to submit the following questions for your consideration, and request the favour of answers, as early as they can be furnished, consistently with your convenience.

Very respectfully,
ROBERTS VAUX,
Chairman, &c. &c.

Philadelphia, 7 mo. (July) 3, 1817.

First. Whether what is commonly called a high pressure engine is, in your opinion, proper for a passage boat; whether, with the precaution of proving the boiler once a month, and a double safety valve, as proposed by you, will render them perfectly safe; and whether, in case of an explosion when the steam is at the ordinary pressure at which such engines are worked, it would not probably be fatal to the life of most of the persons on board.

Second. Whether an engine that works with a pressure of from seven to ten pounds to the square inch, would, in case of explosion, probably do any injury, except to persons who were immediately adjacent to the boiler, or who were not separated from it by a partition; and whether the common partition in use in boats navigated by low pressure, and the distance at which passengers on deck or in the cabin are from it do not make them safe?

Third. Whether, to your knowledge, boilers on the low pressure plan have not frequently burst without any injury whatever to the passengers; and if any case to the contrary exists, what are the particulars of it? What experience have you on the subject of explosions of high pressure engines, and the consequences?

(No. 3.)

To Roberts Vaux, Esq.

Chairman of a Joint Committee of the Select and Common Councils of the city of Philadelphia.

Sir,—In reply to the further questions proposed by the committee, the undersigned states as his opinion,

1. That whatever be the construction of a steam engine on board a boat, the precautions already recommended in a former report to the committee, are *indispensable* to the perfect safety of the passengers.

2. Although, with due precaution and continual care, the danger arising from engines working with high pressure, may be reduced so as to render them as little liable to explosion as the engines that work with a low pressure, yet accidents must be calculated upon to happen to engines of all and every construction, at one time or other. In such cases, the danger will be far greater from engines worked with steam of high pressure, than with the common engines of Boulton and Watt, or of Fulton. Even in cases where the danger arising from an accident is trifling, the noise, and the vapour that issues from a very small opening in the boiler, or other parts of a high pressure engine, are so much more alarming to persons ignorant of the cause, than when a similar accident happens in an engine of low pressure, that the chance of this happening well deserves to be taken into the account; for the fright and the alarm may have serious consequences, even when there is no real danger.

3. Every engine working with steam beyond ten pounds upon the square inch, ought to be considered as a high pressure engine.

4. Under present circumstances, it seems expedient to give a decided preference to engines in steam boats, where the pressure is below ten pounds on the square inch; for even that pressure is unnecessary, and may, and ought to, be avoided.

5. With respect to the explosions and accidents that have happened on board steam boats, in this country and in England, the statements have been too loose and general, to afford any foundation for an accurate and decided opinion, but enough has been published, to show that these accidents have happened from rashness or negligence,

by means of which, the steam valve has been overloaded, or by using machinery ill made, or too much worn. A steam engine on the construction of Boulton and Watt, may rashly or negligently be loaded with fifty pounds instead of five pounds; but it is manifest, that steam pressed with twenty pounds for instance, cannot possibly do so much damage as steam pressed with two hundred pounds on the square inch. In the latter case it would act nearly with the force of gunpowder, as there is good reason to believe it has often done.

6. As in all civilized countries passengers are under the protection of the law, and ferries and carriers, whether by land or water, are objects of legislative control, this subject seems to the undersigned proper to be submitted to the consideration of the legislature.

THOMAS COOPER.

July 7, 1817.

(No. 4.)

SIR,—In answer to your inquiries, respecting high pressure engines, and those on the Boulton and Watt principle, with steam from seven to ten pounds on board of passage boats, I submit my opinion, without any other motive than that for the safety of the lives of those who travel by that convenient mode.

1st. As respects high pressure engines, I am of opinion, that if the precautions recommended in a former report are rigidly enforced, perhaps explosions would not take place; but presuming that, with all the care of those appointed to make a monthly survey, some part of the work might be overlooked from hurrying the examination, in order to have the boat ready for the succeeding trip; this induces me to believe that it is probable fatal accidents may occur, and many lives be lost, if an explosion should take place.

2nd. An engine that is worked with a pressure of from seven to ten pounds to the square inch, with a boiler reasonably strong, there can be little danger of explosion; but should an explosion take place, I am well persuaded that the danger to passengers in the cabin, or on deck, would be trifling, provided the partitions and deck between the boiler and the cabin are sufficiently strengthened, *and the doors, if admitted at all*, are hung in such way that by the concussion occasioned by the explosion, they would fly shut; I would recommend an additional passage from the cabin to the deck in the after part of each boat, that in case of accidents a more ready passage would be at hand, without being obliged to pass out near the boiler, as is now the case in most of the steam boats on the Delaware.

3d. The only burst which has come to my knowledge in working low pressure steam, happened with one of the boilers at the lower engine of the Philadelphia water works, occasioned by the heads of the bolts burning off over the fire place, and the joints parting; the workmen received no injury, as the fire doors were shut, the boiling water passed into the ash pit.

From all the information I have obtained, it appears, that every accident that has occurred was occasioned by high pressure steam,

applied either in engines adapted for working high steam, or those of Boulton and Watt, which were never intended by the inventors to carry more than six pounds on the extreme. As the Boulton and Watt engines are now worked, with from ten to twenty pounds pressure, I conceive the danger of explosion nearly as great, as with those working at a pressure of one hundred and fifty pounds to the square inch, and in some instances greater, where the construction of the boilers is not adapted to carry more than from seven to ten pounds with safety.

I am not sufficiently acquainted with the injuries that have taken place by the explosions of boilers in working high steam, to give any correct information on that subject.

In order to prove my assertion in favour of working low pressure steam on board passage boats, I submit calculations of the dead pressure acting on each sort of boilers when ready to put an engine in motion.

The dimensions of boilers most approved of for high steam, are cylinders of wrought iron, generally twenty feet long, and two feet six inches in diameter, which, calculated at 150 pounds to the inch, is on the whole superficial surface 3,595,800 pounds, or on each inch in width of the circumference 14,100 pounds, or on the superficial foot 21,600 pounds.

A boiler for a Boulton and Watt engine, built on the same plan, with the same materials, twenty feet long and seven feet diameter, calculated at ten pounds pressure to the inch, is on the superficial surface, 742,020 pounds, or on the circumference 2,630 pounds, or on the superficial foot 1,440 pounds.

From these data, it is obvious that the latter principle must be the safest.

I am, with great respect,
Your obedient humble servant,
FRED. GRAFF.

Philadelphia, July 9, 1817.
ROBERTS VAUX, Esq.
Chairman of the Select Committee of Councils on the subject of Steam Boats.

(No. 5.)

Philadelphia, 8th July, 1817.

SIR,—In reply to the further questions proposed by the committee, the undersigned is of opinion,

1st. That all engines, worked with a pressure above from five to seven pounds the square inch are unsafe, unless the precautions already recommended in a former report to the committee are adopted. That engines which work with a pressure of seven pounds and below, need only a second safety valve, without the proof; for, should an explosion take place, experience shows that the passengers would be perfectly safe. There is no doubt, that in case of an explosion, the higher the steam the greater the danger; but engines may be so

constructed, that there would be no danger, even with a pressure of 150 pounds to the inch. Boilers may be made to withstand the pressure of 600 pounds to the inch, and if proved often enough to detect any defect occasioned by corrosion, or otherwise, it would seem that no explosion could possibly take place.

2nd. If boilers were made so weak as to be *sure* of bursting at a pressure of seven pounds, or below, there would be but little or no danger from such explosions; but boilers have many modifications; some will burst at the low pressure of four pounds, when others will not burst at 300 pounds. The boilers that are constructed to bear the pressure of twenty to fifty, or sixty pounds, the undersigned is of opinion, are the most dangerous, since it is more easy to get the steam up to that height, than to raise it to from 150 to 300 pounds.

3d. As far as the knowledge of the undersigned extends, all explosions that have taken place, where the engines have been worked at seven pounds and below, have done no injury to the passengers. It is the boilers that have been made to bear a higher pressure than seven pounds to the inch, which have proved so fatal; but had the owners known their strength, and been provided with safety valves properly adjusted, no explosions would have taken place, unless they had been constructed like the two on the Mississippi, which have produced such disastrous consequences. This form of boilers should certainly be abandoned; no safety valve, nor any precaution, would make them secure. These boilers are cylindrical, and have flues passing through their centres. The misfortune has not happened by the bursting of the boilers, but has been occasioned by the flue, where the fire is built, being heated to such a degree, when the water has been suffered to get too low, so as to collapse and make an opening for the steam and water to rush out. This was the case with the Washington and Constitution. At the Pittsburg nail factory, where Evans's most improved boilers had been used for a number of years,* it was apprehended that it was time to replace them, and while new boilers were making, one exploded when the steam was at sixty pounds. When examined, it was found that a piece was blown out at the top, about four by six inches. It removed a few bricks, but occasioned no mischief. It was found that the thickness of the iron was reduced by corrosion to less than one sixteenth† of an inch, at the spot where the explosion took place. The undersigned has not been informed particularly, as to the other disastrous explosions, but he believes several have taken place at as low as twelve or fifteen pounds pressure, and that such ought to be considered as high pressure engines.

Yours, respectfully,

JACOB PERKINS.

ROBERTS VAUX, Esq.
Chairman of the Select Committee of Councils on the subject of Steam Boats.

* This rapid corrosion was occasioned by the use of mineral water: since river water has been used no such event has taken place.

† When new it was five sixteenths.

On the Structure and Management of Steam Engine Boilers. By Col. S. H. Long, *U. S. Engineer Corps.*

TO THE COMMITTEE OF THE FRANKLIN INSTITUTE.

Philadelphia, July 9, 1830.

Gentlemen,—At your request, I have the pleasure to submit a few hasty remarks in reference to defects in the construction and management of the boilers of high pressure steam engines, and to the accidents liable to result therefrom, to which I shall take the liberty to add a few observations on the means of preventing their explosion.

The Western Engineer, which was constructed under my immediate direction, and in which the exploring expedition under my command travelled from Pittsburg to the Council Bluffs, in 1818, had three cylindrical boilers, about 15 feet long, and 20 inches in diameter, the iron of which they were made being $\frac{3}{16}$ inch thick. The position of the boilers was horizontal, and their direction parallel to each other, and to the sides of the boat. The fire places were located at the front, and immediately beneath the two exterior boilers. The flues extended backward from the fire places quite to the aft end of the boilers, where they united under the centre boiler, and were returned through a single flue, to the front, and thence ascended through the deck of the boat, passing upward in a chimney about 19 feet high.

The ordinary working pressure of the steam, was 96 pounds to the square inch, as indicated at the safety valve. On some occasions, the pressure was raised to 128 pounds per square inch.

No precautions were taken to cleanse the boilers of the mud taken in from the turbid waters of the Mississippi, till we had ascended about 170 miles in that river; when, in consequence of the difficulty of generating a sufficiency of steam, it was thought best to examine and cleanse the boilers. On removing their caps we discovered that a large quantity of mud had been collected, which was not equally distributed in the boilers, but appeared to have been accumulated in greatest abundance, at those parts of the boilers which had been subjected to the greatest heat, while other parts were comparatively exempt. For example, those parts of the exterior boilers, immediately above the bridge at the backs of the fire places, and especially that portion of the centre boiler immediately above the junction of the two exterior flues, were incrusted with mud to a very considerable thickness. The mud, or rather crust, on the portion last mentioned, was at least two inches thick, and, on further examination, it was found that this portion of the boiler had been enlarged, or *blown out*, (*bladder-like*,) till the apex, or extreme surface, of the enlargement had receded from the original cylindrical surface of the boiler about $1\frac{1}{2}$ inches. An explosion was no doubt prevented in this case by the cracking of the mud crust, and the admission of water through the cracks, the former being occasioned by the enlargement of the interior surface of the boiler at that place, and the latter serving to cool the enlarged side of the boiler before an explosion could take place.

It has frequently been observed, in reference to the steam boilers employed in the western country, and especially to those in which steam is generated by the heat of an intense coal fire, that

those parts of the boiler exposed to the greatest heat, soon became oxidized, and reduced in thickness by exfoliations. This is probably to be accounted for on the supposition that in consequence of the rapid production of steam, a very thin atmosphere of it is formed on the interior surface of the boiler, at such points as are exposed to intense heat, and prevents the water from coming into immediate contact with the boiler.

In the spring of 1820, I embarked at Pittsburg on board of the steam boat Telegraph for St. Louis. The boat was entirely new; had her cabin above the main deck; her boilers in the bow; and her engine and paddle wheels at the stern. The supply or force pump, was, of course, connected with the engine, and the water had to be conveyed to the boilers through a distance of at least 60 feet. The supply pipe was of wrought iron; it ascended from the engine to the upper deck, passed along the upper deck to the aft end of the boilers, descended to, and entered, a horizontal pipe situated midway from the top to the bottom of the boilers, and communicating with them respectively at or near their centres.

Among a variety of accidents that occurred on board of this boat, was the following, which is to be regarded as having a particular reference to the subject before us.

We had not proceeded many days on the voyage, when all on board were alarmed at a sudden and apparently unaccountable cracking and knocking in the supply tube, attended with shocks in that member of the machinery, which produced copious jets throughout its whole extent. This accident was no doubt occasioned by a scarcity of water in the boilers, by reason of which the *debouchures* of the supply tube were left uncovered with the water, and the steam from the boilers gained admission into the supply tube, and on coming in contact with the cold water of the tube instantly condensed.

The surest and safest mode of applying the supply tube to cylindrical boilers, is that effected by means of a horizontal tube, situated transversely of the boilers, a little back of the fire place, and beneath the apron of the aft part of the furnace, from which tube branches lead upward and communicate, through the furnace, with the lower part of each boiler. This tube has sometimes been accidentally stopped, and the passage of the water to one or other of the boilers has been thereby prevented. In order to avoid accidents from a cause like this, especial care should be taken to have the tube large, and free from obstructions of every kind, and especially from nails, &c. which are often used in the construction of *cores* for casting, and are sometimes inadvertently left in the tube.

A piece of timber in contact with, and resting upon, the tops or upper parts of a set of cylindrical boilers, has been known to take fire from heat communicated through the boilers, (probably while the steam engine was in operation,) although the ignited timber was considerably remote from any fire flue. This occurrence was no doubt owing to the transmission of heat through the steam contained in the boiler, resulting from a scarcity of water in the boilers, by reason of which certain portions of them exposed to a strong heat, were not covered with water.

The mode of constructing furnaces for cylindrical boilers, (in the western country,) is such that the heat is communicated to the outsides of the boilers, to the height of about three inches above a horizontal line passing through their centres. Moreover, the longitudinal fire flues usually introduced into the boilers are so situated that their upper sides rise at least to the same elevation, and sometimes higher. Hence, unless the water of the boilers rises to a height somewhat greater than either of those above adverted to, the accident above mentioned, and even others of a more fatal aspect are liable to take place.

These considerations afford a double clue to the prevention of accidents of this nature, viz. 1st. the necessity of a sure test for determining and maintaining the proper quantity of water in the boilers, and, 2nd. of a test by which any difference between the temperature of the water in the boilers and the steam above it, may be detected.

It is true that an increased temperature in the steam above that of the water is serviceable, in preventing the condensation of the former in its passage from the hotter to the cooler parts of the machinery, in which last it must necessarily perform its functions; nor is it deemed impracticable to effect this valuable purpose by suitable apparatus. Yet, in the present structure of the steam engine, safety would be more promoted by maintaining a uniform temperature, both in the water and the steam contained in the boilers.

I shall conclude with a few speculations, suggested in the course of my limited experience and observations, in reference to steam boilers. The remarks I have to offer under this head, are grounded upon certain properties of materials, which I am inclined to think have not been sufficiently consulted in the construction and use of machinery generally, and of steam boilers in particular.

It is a pretty well established fact, that the continuity, tenacity, or strength of materials, is constantly impaired by every force exerted upon them, and by every action they perform, whether continuous or intermitted. For example, a rope or cord continually strained, gradually parts with its tenacity. A spring continually, or occasionally, bent, loses its elasticity. A bell, after having been rung steadily for a long succession of years, will break. The trunnion of a field piece may be broken off by repeated strokes of a hammer or sledge; the number of strokes required for this purpose being in some due proportion to their intensity, and the weight of the hammer. In fine, I have no doubt that all materials, (inasmuch as none are *perfectly* elastic,) are subject to this law.

The inference to be drawn in relation to steam boilers is, that their strength is constantly impaired by the strain exerted upon them, and that, in consequence, they ought to be more frequently tested or proved, in order to determine their ability to resist the pressures to which they are subjected. It is believed that, in most instances, boilers have never been tested beyond their ordinary working capacities; and that whenever they have been proved, a single trial has been deemed sufficient for the entire duration of the boiler.

In order to obviate the danger attendant on experiments of this sort, and to render the trial as economical, easy, and expeditious as

the nature of the case will admit, I would suggest the following method. 1st. Let experiments be carefully instituted and made, for the purpose of determining the tenacity of the different kinds of iron, &c. employed for the construction of boilers, at all the varieties of temperature to which they are subjected in the *raising* and *working off* of the steam. From these experiments let a table be formed showing the diminution of strength for every degree, or 10 degrees of increased temperature, and especially for all temperatures above the oiling point.

2nd. Let a weight be attached to the lever of the safety valve, sufficient to produce a pressure upon the valve, at least one-fourth greater than that imparted by the highest steam ever intended to be used in the boilers; due allowance being made for the reduction of tenacity occasioned by the degree of temperature corresponding to the steam pressure required, which temperature may be determined by a recurrence to Dalton's tables, showing the temperatures corresponding to different densities of steam.

3d. Let the force pump be adjusted in such a manner as to be worked by hand, (by means of a handle or brake adapted to that purpose,) with a view to communicate by manual exertion the pressure requisite to raise the safety valve.

4th. Let the boilers be filled with cold water, the safety valve be closed, and the force pump worked vigorously, till a force is communicated sufficient to raise the safety valve, and the strength of the boiler will have been sufficiently tested. The trial, and proof, may be made as often as occasion may seem to require, and the boilers effectually proved, in half an hour, without serious inconvenience.

Having no leisure to revise and copy, I must crave your indulgent acceptance of the foregoing rough minutes.

I am, very respectfully,

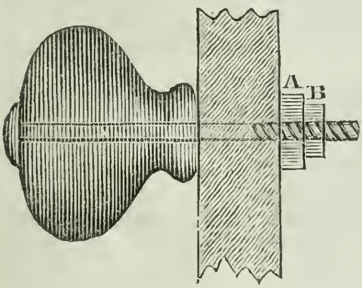
Your most ob't.

S. H. Long.

Secure Fastening for Drawer Knobs.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—I have been often plagued in my furniture by the glass knobs, now so much used, becoming loose; and I find that no successful expedient has hitherto been adopted to remedy this annoyance. After several fruitless efforts, I have at last hit upon a plan, which I have found to be completely effectual, and at the same time, it is very simple. The annexed cut being a section of the knob and spindle, will represent the contrivance.



A, is the ordinary nut. B, an extra nut, which I form octangular, or hexagonal, to make a better finish. Putting on the knob and spindle, as usual, I

screw up the nut A, until the knob has the degree of tightness at which I wish it to remain. Placing then a key, made of a plate of brass or iron, on A, to keep it from turning, I screw B strongly against it; and I find that on turning round the knob and spindle they carry with them both the nuts, if properly put on. The reverse of this, in ordinary cases, is the cause of the knobs becoming loose.

The use of two nuts clamping each other, is familiar to all persons conversant with machinery; all the merit I claim, is that of applying this well known contrivance to the remedying a domestic annoyance, which, from its frequent occurrence, may be termed a serious evil. W. H.

Baltimore, September 15*th*, 1831.

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Franklin Institute, was held at their Hall, on Thursday evening, August 25th, 1831.

Thomas Fletcher, Vice President, in the chair.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute.

By Messrs. Carey and Lea.

The Family Dyer and Scourer, being à Complete Treatise on the art of Dying and Scouring.

By Mr. Reuben S. Gilbert.

The Cabinet of Natural History and American Rural Sports, No. 8, *for August.*

By Mr. W. C. Redfield.

Remarks on the prevailing Storms of the Atlantic Coast of the North American States, by the donor.

A letter from Hardman Phillips, Esq., of Phillipsburg, Pa., was read, accompanying the following specimens, viz:—

Coke made by the process of distillation.

Coke made in the open air; and

Iron in the various stages of its manufacture, from the ore to the completion of screws.

Mr. Phillips says, "my principal object in submitting these specimens to public inspection is, to invite the manufacturers of Philadelphia, to the study of the resources of their own state, (so well calculated, if duly fostered, to render the country independent of foreign supplies.")

He also states, "that after the process of making the blooms, which is done at the forge, the principal part of the subsequent manufacture is performed by boys from the charitable institutions of Philadelphia. Neither is there a single mechanic at this time about the works who has not learnt his trade at them."

The corresponding secretary laid on the table the following works received in exchange for the Journal of the Institute.

Recueil Industriel, for March.

Bibliothéque Physico-economique, for May.
Annales de Chimie et de Physique, for February.
Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for January and February.
The Ladies' Book, for August.
Southern Agriculturist, for August.
The Illinois Monthly Magazine, for July.

Mr. Keating stated that the Horticultural Society of this city had issued a circular asking for information relative to the cultivation, consumption, &c. of dyer's madder, barilla, and woad, which has been republished in the Journal of the Institute—whereupon, this subject was selected for discussion at the next meeting of the Institute.

THOMAS FLETCHER, *Vice President*.
J. HENRY BULKLEY, *Rec. Sec.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1831.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in the *Mill for grinding Grain;* John Ambler, Jr., and Daniel C. Ambler, New Berlin, Chenango county, New York, June 13.

The Messrs. Ambler obtained a patent on the 6th of Dec. last, for an improved portable grist mill, the runner of which was to be kept down by means of heavy weights; the present patent is taken for some further improvements which have been suggested by experience. The mode of hanging, balancing, and driving the stone has undergone some alteration; but the principal point appears to be the substituting of a spring for the weighing formerly employed to keep the running stone down. To a beam above the stone "is attached a spring so placed that it acts on the steel point, and holds it firmly in contact with the safety rod,—which prevents the upper stone, or runner, from rising when the feed is fast. In case any large articles pass between the stones, this spring yields, and allows the stone to raise sufficiently to let the article pass between them." "The eye of the runner is to be made larger near its face than it is above."

"The parts to which we lay claim as original are the manner in which the upper stone is prevented from rising when grinding fast, by means of a spring, and the arrangement of the parts as specified; also the making the eye of the runner larger near its face than it is above; and the manner in which the upper stone is balanced and driven."

---

2. For improved modes of *drawing off two separate liquids, which, by their union, produce an effervescing beverage;* John Ambler, Jr., New Berlin, Chenango county, New York, June 13.

This patent is taken for an apparatus similar in its object to that described at p. 176, patented to Justice Perkins, May 3.

---

3. For a *Carriage to run on Rail-ways;* William Bryant, and Isaac Keit, Davidson county, Tennessee, June 13.

This carriage is intended to run upon a single rail, in a manner resembling that of Palmer's, patented in England. The carriage is suspended so as to hang below the rail upon which the wheel runs. From the frame by which gudgeons of the main wheel are sustained, an arm projects, upon which there are wheels, or friction rollers, which acting upon the top, and on each side of the rail, serves to guide the carriage, and renders it unnecessary to use flanches.

The whole apparatus is described and figured without any part being designated as new, although it is manifest that the principle has no claim to novelty. The particular arrangement of the parts described, differs sufficiently from that adopted by Palmer to have admitted of a specific claim.

Notwithstanding the apparent simplicity of the *single rail*, its employment involves a complexity in the adaptation of the carriage, and in other particulars which appear to be objectionable. We believe that Palmer's rail and carriage have been used for the purpose of experiment only; at all events, we have never heard of any thing further respecting them, although they were patented three or four years ago. To sustain a rail at the height required by this plan, with that degree of stability which is necessary, offers such practical difficulties as are very likely to prevent its adoption.

---

4. For a machine for *Shelling Corn and Cleaning Grain;* Ezra Bond, Mendon, Monroe county, New York, June 13.

The patentee tells us that "the said machine consists of a cylinder and curve, with iron spikes in each. Also wire screens, and wooden wings for winnowing grain; and a revolving apron to conduct the grain into the machine. The said curve springs agreeable to the quantity of corn or grain between the spikes of the curve and cylinder, all of which move by turning of a crank; and for a more full description, a drawing is herewith annexed, to which reference may be had, and which forms part of this specification."

It will be seen that a number of old acquaintances are congregated together in the foregoing description, and upon examining the different features they all appeared perfectly familiar. We, however, shall imitate the patentee, and not make any claim to them, as they make no part of our own offspring.

---

5. For an improvement on the *Mechanical Fan,* patented on the 27th November, 1830; Jas. Barron, Esq., Navy Yard, Philadelphia, June 13.

In the former specification, the fan was made to vibrate, like a pendulum, by means of a weight acting upon wheel work. The improve-

ment now claimed is the "giving motion to the fans, &c., by means of two pulleys, and a connecting band, producing a rotary, instead of the crank vibratory, motion, formerly used."

A suitable frame is made to sustain moveable pulleys, and a weight which is wound up like the weight of a jack. Arms project from the top of the frame, and from these descends a rod, at the bottom of which there is a "cross bar, or stick, on which are placed the fans and shreds, or threads, for creating a breeze, and driving away the flies and moschettos."

This plan is much more simple than that originally patented, and noticed in vol. 7. p. 170. For a machine to keep off flies, we have employed an apparatus intended for another purpose, which is no larger than a quart mug, and one that may be frequently found for sale at our stores; we allude to the spring roasting jack, which is wound up like a clock, and will run for an hour or more. The fanning, or fly driving apparatus occupies the place of the meat, and instead of roasting the dead animal, the living one is cooled, and protected from the flies.

---

6. For a *Complete Churner;* Cyrus Baker, Charlton, Saratoga county, New York, June 13.

This is the common dasher churn, but it is to be worked by machinery. A frame is made, across the upper part of which there is a shaft with a crank at its centre; a pitman, or shackle bar, descends from this shaft to the dasher of the churn. A large cog wheel is to be turned by a hand crank, and this takes into a pinion on the crank shaft, which works the dasher up and down.

Four pages of description introduce us to a knowledge of the structure of the foregoing machine, which, after all, has about as much claim to novelty as it has to simplicity.

The claims are to the use of the cog wheel, to the way in which the holes are slanted for the play of the handle, &c.

---

7. For an improvement in the *Machinery for Spinning Cotton, &c.;* John Brown, Stonington, New London county, Connecticut, June 13.

Those who are acquainted with Thorp's ring groove spinner, and with the various modifications of that invention, which have been described in this journal, will perceive that the improvement claimed by Mr. Brown consists of another variation in the mode of applying the same principle.

"The ring is made of steel or iron, turned true, having a groove on each side near the inner edge. In this ring is a sliding piece let in about half way the thickness of the ring, to admit the travellers for guiding the thread. The travellers are small pieces of hardened steel, bent in a circular form,—open at one side. They move in the grooves in the rings, and guide the threads."

The claim is to the "making the ring in two parts, so as to admit the travellers;—hardening the travellers; making also a double ring

with a groove between them to admit the traveller to run in it. Likewise the mode of giving the machine an accelerated motion."

---

8. For a machine called a *Self-balanced Hand Cart;* George Coolidge, Watertown, Middlesex county, Massachusetts, June 13.

This is a kind of hand cart, or barrow, for removing earth in excavating for canals, and other purposes. The body is made with the sides sloping, and is suspended upon two wheels, 4 feet 6 inches in diameter, by means of gudgeons, or axles, which are attached to the body near its upper edge. There are shafts, or handles, which are formed by the elongation of the top timbers of the frame of the cart, and a leg extending down from each shaft, like the legs of a wheel barrow. The bottom of the cart is made to fall, being made in two parts, which are hinged to the front and back of the frame, like two shutters. From these shutters, rise chains, which hitch on to a pin on the side of the cart, when the shutters are closed. A lever, which passes out alongside one of the shafts, acts upon the chains, and lowers or raises the bottom.

The use of the legs is to support the weight of the shafts, and the action of the lever; as, were these removed, the body would still remain suspended, the principal part of it, and its whole load, being below the point of suspension. The whole of the body lies within the circumference of the wheels, its length not being equal to their diameter. The earth is, in general, to be dropped by letting down the bottom, but when it is moist and adhesive, the body is to be inverted by raising the shafts, and turning them completely over.

The wheels are, of course, to run upon planks laid down for the purpose. Each cart is to contain 11 or 12 cubic feet of earth, and a number of them may be linked together, and drawn by horses.

There is no claim made, and perhaps the general plan is sufficiently novel and distinctive without particularizing the parts. There is, however, one effort at exactness which, were specifications to be construed rigorously, would endanger many a patent; namely, the precise dimensions of all the parts. We are told, for example, that "the wheels are $4\frac{1}{2}$ feet high; spokes $1\frac{3}{4}$ wide, and $1\frac{1}{4}$ thick; felloes $2\frac{1}{2}$ inches wide, $1\frac{1}{2}$ inches deep; tire $2\frac{1}{2}$ inches wide, and $\frac{1}{4}$ inch thick." And so of all the other parts.

---

9. For a machine for *Chopping Meat, Pulverizing Spices, Hommony, &c.;* Benton P. Coston, city of Philadelphia, June 13.

A round wooden block is to have its upper end excavated in the form of an inverted cone; a cylinder of tin, or other metal, is to extend up from this excavation to form the sides of the mortar. A chopping knife, with two edges, adapted to the cone, is to be fixed on to one end of a handle, or shaft, and at its other end there is fixed an iron pestle. The shaft is to slide in guides, keeping the knife or pestle in the centre of the cone, and one end, or the other, is to be turned downwards, according to the kind of work to be performed.

There is no claim made, the whole, wooden mortar and all, being, of course, considered as a new *invention.*

---

10. For *Propelling Machinery, and driving the Stones in Grist and Flour Mills;* Jeremiah Case, Sodus, Wayne county, New York, June 13.

This is for a reacting wheel, and we are told that "the improvement is in the application of the reacting wheel to the shaft to which the stones are attached, without gearing; by which greater velocity is gained with equal power, than by any other method now in operation, rendering the use of gearing unnecessary." "The reacting wheel, which is three feet diameter, is placed on the lower end of the shaft, in a horizontal position, and at the foot of the shaft is inserted a concave iron box, resting on a pivot of hemlock knot, or other hard wood, placed upright in the bridge tree." These are the main points of the description, after which the patentee adds, "I further claim as my invention, an improvement on the reacting wheel, in the construction of the buckets which allow an equal space through them for the discharge of the water; avoiding the inconvenience to which these wheels have hitherto been subject by being made wedging, and thereby retarding the motion. I also claim as my improvement, the use of the wooden pivot, and the mode of applying it to the concave iron box, as mentioned in my description."

The drawing is a very poor affair, but there is a sketch of the wheel intended to be used, which appears to be that invented by Calvin Wing, and described in the specification of a patent obtained by him, inserted p. 87 of our last volume.

ENGLISH PATENTS.

To THOMAS COBB, *Esq. for his invention of certain improvements in the manufacture of paper, intended to be applied to the covering of walls or the hanging of rooms, and in the apparatus for effecting the same. Sealed* 15*th September*, 1829.

THE invention for which this patent is granted, is a mode of producing an embossed surface of papers intended for covering walls of rooms, by which a beautiful effect can be produced on papers which are coloured in the pulp, and not stained after the paper is made, as is usual with paper hangings; and by which also, silks, velvets, or other coloured goods can be put upon the surface of paper, and when embossed will produce a rich and beautiful appearance.

SPECIFICATION.

"My improvements in the manufacture of paper, intended to be applied to the covering of walls or hanging of rooms, and in the apparatus for effecting the same, consist, first, in manufacturing tinted or coloured paper intended to be applied to the covering walls or

hanging rooms, by impressing them with patterns during the operation of making; secondly, embossing paper with patterns for the same purpose, after the paper is made, and which, by the pressure it receives during this operation, is made to resemble plain damask or figured silks; thirdly, in uniting two or more thicknesses of paper together for the same purpose, previously to their receiving the embossing, one of which may be coloured paper, and the other white; fourthly, in uniting for the same purpose, paper with silks, velvets, and other fabrics, so that, if plain, they may receive an impression or pattern by embossing, and may also be struck on walls with the same facility as paper only is commonly done; and, fifthly, in the apparatus for uniting the paper or papers, and other fabrics, as above mentioned. First, in some cases, I make a coloured or tinted paper, and in doing this, I dye or stain the rag or pulp by any of the known methods of dying or staining them, and make it into paper in the usual way; and during the process of manufacture, and before it is dry, I cause it to pass between rollers, and receive an impression therefrom, one or both of which rollers are engraved, stamped, or impressed, or covered with something that will give the pattern or figure required, by which operation it is impressed, and receives a pattern or figure; or the same thing or effect may be obtained by using plates or other flat substances, in or on which the required pattern or figure is formed, by laying them on the paper in its way to the pressing rollers, so that in passing through them, it receives the figure or impression.

"Secondly, in other instances, and particularly where I want a shining article to resemble silk, I make my paper as before described, by any of the known methods, and when dry, I pass it through rollers, one or both of which are engraved with the pattern required, and at least one of them heated, so that the impression obtained may be stronger and more shining; and it is not necessary the paper for this purpose should be always coloured or tinted in the rag or pulp during the process of manufacture, but either coloured paper so made, or paper which has been made white, and afterwards coloured by any of the known methods, will do equally well for this purpose; neither is it necessary the paper should be made in long lengths, although I prefer it so, and it may either be made so by machinery, or a number of sheets may be joined together, or sheets may be impressed by either the heated rollers or plates passed through heated rollers, and united in putting them on the walls so as to form the pattern intended, when combined. In some cases, I give part of the impression during the operation of making the paper, by which it is twilled or lined, ribbed or striped, by passing it through rollers prepared according to the purpose intended, which causes it to appear thicker than if pressed flat and smooth, and prepares it to receive a stronger impression; and I afterwards, when nearly or quite dry, pass it through other rollers, one or both of which are heated, and on which are other patterns, so that part may be shining and other parts not so; and whenever it is particularly desirable that the paper should retain its shining quality in a greater degree, I size it strongly with

animal or vegetable substances, and sometimes use gums or wax therein.

"Thirdly, I contrive to unite two or more thicknesses of paper together, either during the process of making, or afterwards, by introducing between them any of the glutinous substances, or articles, calculated for the purpose, and one of these papers may be of any colour required for the outside, and the other may be coloured or white for the back, and may also be of a coarser and stronger description than that which is intended for the outside: and when these papers are so united, they are passed through the pattern and heated rollers, or pressed with the plates as before described, to give the pattern required: and in general I prefer these double or compound papers to those which are of one sheet or thickness only, as they take the impression and preserve the patterns better, and are less injured by the operation of pasting, in putting them upon the walls.

"Fourthly, instead of the double paper before described, I take plain or figured silks, satins, velvets, cottons, linens, or other fabrics for the one side, and unite these with paper by introducing any of the glutinous substances, or articles calculated for the purpose, between them, in the way before described when two or more thicknesses of paper are used; and when so united, if the article is plain and wanted to be figured, I emboss it with any pattern required, in the manner before described, and by ribbing or twilling it, by passing it through rollers prepared to give it this appearance after it is united with the paper, I give an inferior silk the appearance of a much more valuable one, and allow of the paper thus united being pasted and stuck on walls in the same manner, and with as great facility as though it were paper only.

"In either of the cases before mentioned, I produce the embossing effect by means of a swing press, where the figure or pattern occurs but seldom, to the screw of which press a plate with the intended pattern is attached, having a chamber above it to receive a heater, for the purpose of making the impression stronger and more lasting. With this and the other modes of embossing, I sometimes use leaf gold, or other metallic substances, so that the whole, or part, of the impression may be covered thereby, (as in the binding of books,) and in some cases I take paper which is already covered with gold, silver, or other metallic substances, and emboss and cut out the figure intended, so as to fit the impression made in embossing. In other cases, and particularly when plain silks are united with paper, I produce a pattern, or effect, called watering, by pressing two thicknesses or pieces together between heated rollers, or in a press face to face, so that during the operation of pressing, one may bruise the other, and produce the effect described.

"The patterns intended to be employed for the above purpose, admit of all the varieties of engraving and impressing, which can be used for embossing, in the manner before described, and they may be made to appear as though they were woven in the material, or embroidered or embossed thereon, according to the article which it is intended to resemble, the intention being to make paper appear

like silks, cloths, &c., of greater value than itself, and to have a similar effect in improving the appearance of silks, or whatever articles are united or combined with the paper; and the novelty of my invention consists in giving the improved appearance in the manner herein described, to papers intended to be applied to the purposes of covering walls or hanging rooms, as above stated; I do not claim any thing new in the process of making paper, farther than what is described under the first head, viz. the method in which the figure or impression is given during the manufacture of the paper for this particular purpose; and though embossing has been used for various other purposes, yet I claim it as new when applied to papers prepared in the manner described, or when united with other fabrics for the purpose of covering walls or hanging of rooms, as above said."

[*Lond. Jour.*

To WILLIAM DETTMER, *Piano Forte Maker, for his invention of certain improvements on piano fortes. Sealed* 30*th August*, 1827.

THE object of the patentee in adapting this invention to piano fortes, is to enable the instrument, after having been properly tuned, to be brought into unison with other instruments of a different pitch, by raising or lowering the tone of all its strings by a simple operation, instead of the trouble of tuning each string separately.

The plan applies both to grand piano fortes and square piano fortes, and whether horizontal or upright, and consists in adapting to the ordinary construction of instruments, a series of tension bars or rods, with adjustments which are to extend across the instrument, and to be connected to the block in which the pins that hold the strings are fixed, the blocks being moveable for a short distance, not more than a quarter of an inch, but confined by the tension bars.

The general construction of the piano forte, as to the keys and movements, and the arrangement of the strings, the blocks for the hitch pins and for the rest pins, being the same as in other piano fortes, the novelty consists in attaching the ends of a series of metal bars, or rods, to the hitch pin blocks, and connecting the reverse ends of the same bars to the rest pin block; these bars being enabled to elongate or contract by means of adjusting screws.

Supposing each of the strings of the instrument to have been drawn up by the turning key to the required note, that is, properly tuned, but that when so tuned the whole should be found to be too flat or too sharp to play in concord with other instruments in a concert; by simply moving the adjusting screws of the tension bars, the blocks to which the strings are attached will be brought nearer together to flatten the tone, or farther apart to sharpen it, as may be required, without deranging the tone or notes of the individual strings.

The patentee says that both the blocks on which the strings are hitched, and that in which the rest pins are set, may be made to slide, but he prefers that the rest pin block only should move, and this may be done by passing the adjusting screws through the block into the

tension bar, when, by turning the screws, the block will be moved a short distance, and the tension of all the strings will thereby be increased or relaxed.

The same effect may be produced by means of wedges or levers, or some other contrivances, in place of the screws, but that which has been described is preferred. [*Ib.*

To JOSEPH HORTON, *boiler maker, for his invention of a new and improved method of forming and making of hollow cylinders, guns, ordnance, retorts, and various other hollow and useful articles in wrought iron, in steel, or composed of both those metals. Sealed* 11*th October*, 1827.

THESE hollow cylinders are proposed to be made by combining a series of bars of iron or steel, placed lengthwise round a cylindrical mould, and after bracing them together by means of iron hoops, and raising the temperature of the whole in a furnace to a welding heat, the mass is to be beaten with hammers upon a mandril, until all the pieces are united in a solid compact state.

It is proposed that the several bars shall be made in a small degree wedge-shaped in their sectional figure, in order that they may lay close together, when combined in a cylindrical form, like the stones round the arch of a bridge.

Several modes of effecting this object are proposed beside the wedge form, as, for instance, a series of square bars may be laid, with triangular bars intervening, or some other mode may be adopted for bringing the sides of the bars nearly into contact, before they are submitted to the heat of the furnace; and when so heated, to a welding state, the joints may be closed by tilt hammers, or by sledge hammers, as may be most convenient, according to the magnitude of the cylinder about to be made.

The plan is proposed for making cylinders of iron or steel for any purpose, but particularly for ordnance, which may be formed by these means, observing that the bars for that purpose, must be thicker at one end than at the other, in order to afford such additional substance, as may be required towards the breech part of the piece.

When the gun has been thus formed upon a mandril, and all the joints of the combined bars rendered perfectly sound by the operation of welding, it may be bored within, and turned without to its proper figure, and will be a much better and stronger gun than any heretofore made by the ordinary process of casting. [*Ib.*

Patent granted to S. SMITH, *Builder, for certain improvements in chimneys for dwelling houses, December* 14*th*, 1830.

THIS patentee proposes to constitute chimneys, or rather flues, of iron tubes to be cast of appropriate lengths and diameters, according

to the intended capacity of the flue. These are to be built into the wall, and constitute a circular opening lined with iron. Each piece of pipe is cast with one end somewhat enlarged, to receive the smaller end of the succeeding piece, and when the chimney flues are to be turned from the straight course, kneed or bent pieces of pipe are introduced to give any required curvature.

In addition to the introduction of cast iron tubes, to constitute chimney flues, Mr. Smith claims the invention of a method regulating the size of the flue at the foot of the chimney, by the application of a pair of hollow iron cones, attached at their bases, which must be made equal to the flue in diameter. A cross piece is attached to the apex of the upper cone, whose ends move in slots made for their reception in the lower piece of tubing. From each of the cross bars two chains pass over two pulleys fixed in the chimney, a small distance above the cones, where the two chains are connected, and passed down through an aperture coinciding with the axis of the cones, where it is furnished with a counterpoise. And by this the cones may be elevated so as to close the chimney entirely, and to answer the purpose of a chimney board, when fires are not wanted; or they may be lowered to regulate the opening to any assignable size, according to the required draft, depending upon the quantity and kind of fuel employed.

There is nothing new in the first part of this patent, for a plan of making flues of iron pipes was proposed several years ago.

Mr. Smith's method of adjusting the size of the flue to the draft required appears to be new, and likely in many cases to prove useful.

[*Regis. of Arts.*

Patent granted to MICHAEL DONOVAN, *of Dublin, for an improved method of lighting places with Gas. April* 16, 1831.

IT is a well known fact that hydrogen gas, obtained from the decomposition of water by its being passed through red hot iron, or masses of ignited charcoal, will readily burn if lighted when it comes in contact with the oxygen of the atmosphere as it issues from a pipe; and that its illuminating powers under such circumstances, are so small as to render pure hydrogen inapplicable to the purposes of gas lighting. To augment the illuminating properties of hydrogen, generated under such circumstances, by the admixture of some other gaseous material, is the object of Mr. Donovan's invention. He proposes to convert spirits of turpentine, or similar substance, into vapour by the heat of the gas burner itself in the following manner:—

The hydrogen gas in its passage to the burner passes through a metallic cavity immediately connected with the burner, and in this cavity is introduced a quantity of wire gauze to give extended metallic surface. Into the interior of this cavity is introduced a constant supply of turpentine, which being spread over the metallic surface of the wire gauze, becomes, by the heat of the burner, converted into vapour in the cavity where it mixes with the hydrogen;

giving to it a sufficient quantity of carbon to produce the illuminating powers required. If too much of the vapour of turpentine be mixed with the gas, the issue of an inconvenient quantity of smoke from the burner will take place; and when too small a proportion of this vapour is introduced, a deficiency of light will be the consequence: and, therefore, great care must be taken to proportionate the size of the burner, the supply of hydrogen, the size of the metallic cavity and surface, and the supply of turpentine, to produce the greatest quantity of light with the least smoke. [*Ib.*

Patent granted to BENJAMIN ROTCH, *Barrister at Law, for improved Guards, or Protectors for horses' legs and feet, under certain circumstances. March* 18, 1831.

THE improved guards here contemplated are to be made of caoutchouc. When it is to be applied to a horse's foot the neck is to be cut from a caoutchouc bottle, it is then to be softened by immersion in hot water, and drawn over a block made in the form and size of the foot for which it is intended. On this block it is permitted to cool, when it will retain its shape, and by its elasticity it will adhere to the horse's foot when drawn on it. On the exterior of this shoe is to be applied a sole of sheet iron, made of sufficient size to allow of its edges being cut and turned up round the hoof, to keep it on the foot, but it is also fastened to the Indian rubber by means of very broad and thin round headed rivets; and to the iron sole may be fastened, if required, horse shoes of the usual form.

A method of making and applying the guards for the legs of horses is next described in the specification. For this purpose both the top and bottom of the caoutchouc bottle are to be cut off, the middle piece is then to be soaked in hot water to soften it, and cooled on an appropriate block, as before. One or more of the elastic bands thus prepared are to be applied to such of the legs, or to the knees, of the animal, as require protection; and they will be preserved in their places by the elastic nature of the substance. When they have been laying by in cold weather, they are apt to get hard, and in that case it is recommended that they should be warmed before they are applied. When they are to be used as bandages it may be sometimes necessary to cut them and fasten them with straps and buckles, and in that case the straps must be attached to the caoutchouc at some distance from the edge, otherwise they will be apt to be torn off.

The drawings attached to the specification represent a horse's fore and hind leg, with the guards applied to the feet and fetlock, and to the knee, as well as at the top and bottom of a cloth with a poultice applied to the leg.

With respect to the time, (*twelve months,*) which this patentee has obtained for preparing his specification, we think it deserves notice as a curious illustration of the *laws' delay;* for nobody but a lawyer would have thought of requiring, and very few would have had the means of obtaining, a whole year to mature and describe that which

almost any person at all acquainted with the subject would have readily accomplished in half an hour: for here are neither delicate experimental investigation, requiring time to mature and repetition to confirm, nor intricate mechanical construction, requiring the confidential aid of others to bring to perfection.

We consider that the different periods allowed by the present practice to different patentees for the enrolment of their specifications, is one of the principal defects of the system: and Mr. Rotch, from the experience that he has had in that branch, and to which he recently said to a committee of the House of Commons, that he had directed particular attention, cannot but be aware, that if A, for instance, takes out a patent for an improvement in the steam engine, and takes twelve months to enrol the same, and B subsequently takes out a patent, also for improvements in the steam engine, and obtains but two, four, or six months to enrol his specification, there is nothing to prevent A from inspecting B's specification in the enrolment office, and adopting it as his own; as he was not required to give any description of his invention at the time he obtained the patent.

It is not a little singular, that Benjamin Rotch, Esq. of Bath, on the 11th of May, 1816, took out a patent for "a flexible elastic horse shoe," consisting of "two or more pieces of iron, steel or any other metal, attached either by the nails which fasten the shoe to the foot, or by rivets expressly for the purpose, or sometimes by both, or otherwise fastened or applied to one or more pieces of leather, hat, *Indian rubber*, or any other flexible substance." The application to this circumstance of the following extract from the evidence of Benjamin Rotch, before a committee of the House of Commons, on the patent law, will readily occur to the reader:—

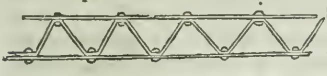
"Look, (says he,) at the danger of allowing patents for improvements, even with the consent of the party, on articles that are already patented; it would continue a patent *ad infinitum:* improvement on improvement, just as their fourteen years are expired; because it is what patentees come to me constantly to know, if they cannot, for some little improvement, obtain a patent on their own patent, which would be an extension of the term to twenty-eight years instead of fourteen, and thereby shut the public out of the benefit they are to have at the end of fourteen years."

Now it would be very interesting to know whether Benjamin Rotch, of Bath, in 1816, be any relation, or at all connected with Benjamin Rotch, of London, in 1830.

Patent granted to WILLIAM CHURCH, *for certain improvements in the construction of Boats and other vessels. March* 9, 1831.

MR. CHURCH proposes to employ sheet iron in the construction of boats and other vessels, as well as for rail-way carriages. The iron plates are to be united by riveting, in a manner similar to that adopted in the construction of steam boilers; and the joints must be all made air and water tight. The exterior of the boat thus

formed, is furnished with a lining similarly constructed. A space of a few inches is left between the exterior casing and the lining; and in this space is introduced a series of iron plates bent into the form represented in the cut, to give strength to the vessel. These



strengthening plates are secured to the casting and lining by rivets or bolts, and the space between the linings is enclosed at the top, air tight; and by that means much buoyancy is obtained from it in cases of danger when the boat fills with water. The deck of the vessel is also to be made of plate iron, which is to be secured and strengthened in a manner precisely similar.

To prevent the mast from being injured by the edges of the iron plates, a piece of iron tube, of dimensions to correspond with the diameter of the lower end of the mast, is introduced through, and firmly secured to, the deck.

The top rail of the bulwarks is made of iron tubing connected together by passing their ends into sockets, and connected with the sides of the vessel by iron plates bent in the form of the surface of a pantile roof, to give them strength.

A description of the Economical Oven, or apparatus for procuring alcohol from dough in the process of baking bread.

Under the head of *New Process of Distillation*, at page 417 of our last volume, we gave some account of the invention for which a patent was granted to Mr. Robert Hicks of London, by which the alcoholic vapour arising from fermented dough in the process of baking, was condensed and collected. We have now procured a drawing of the apparatus employed, which will serve to render the mode of procedure perfectly intelligible. This drawing, with the accompanying description, we have copied from the Register of Arts, for February last.

It will be readily conceived that the numerous small fissures in an ordinary oven of *brickwork*, arising from imperfect fittings and other causes, render the material unfit for the preservation of the vapours given off: Mr. Hicks accordingly employs an oven made of *iron* in lieu of brick; but the bottom of the oven on the interior side is lined with a pavement of bricks, on which the loaves are placed as usual; a fire is made underneath the oven, at a proper distance, and brick flues from thence are so arranged that the heated air shall envelope every part of the exterior of the oven, to diffuse the heat in the interior of it as uniformly as is practicable. The door of the oven is made to fit the frame accurately, by grinding their surfaces, or by luting when set to work, and these parts are brought into firm contact by a cross bar and screw in the usual manner of fastening the mouths of retorts.

In the drawing accompanying the specification, two modifications of the apparatus are exhibited. The first is an oblong oven five feet

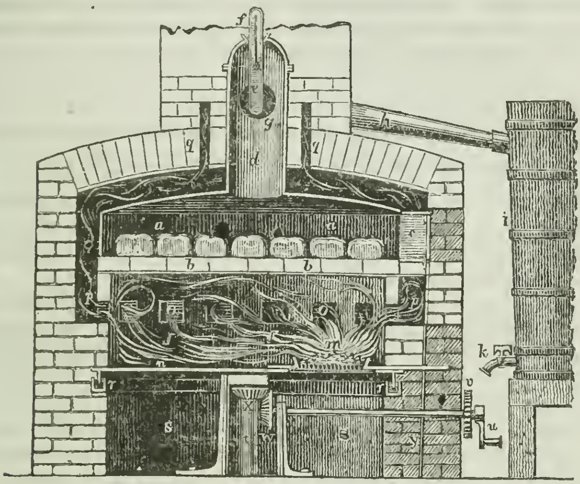
wide and seven feet long, and the fire place, or grated receptacle for the fuel, is placed underneath the middle of the bottom, and is framed so as to be drawn, parallel with the length of the oven, backward or forward, or to be drawn entirely out of the apparatus when required. By the usual position of the fire, however well regulated may be its intensity, there is a liability of the central part of the bottom of the oven to become overheated; partly owing to the bottom being lined, internally, with so bad a conductor of heat as bricks. To protect the oven from this injurious effect, a large plate of iron, about half the area of the oven, and twice that of the fire, is suspended by a hooked iron bar centrally to the bottom of it; and being posited about midway between the fuel and the bottom of the oven, prevents the flame and heated gases from acting directly upon the bottom of the oven. The door of the ash pit is provided with an air regulator, and the minor flues around the oven, (made by numerous holes in the brickwork,) unite in the upper part, where a horizontal flue leads into a common chimney.

In the centre of the top of the oven a large iron tube or neck, about twelve inches in diameter and thirty inches long, is fixed vertically, extending through the brickwork which covers the oven. In this tube the vapours from the bread are collected, and are conducted from thence, by a lateral tube, into a common distiller's worm, which being surrounded by cold water the vapours become condensed, and are drawn off into a proper receiver for the liquid. This liquid, consisting of a mixture of water, alcohol, and other matters, which being afterwards rectified, will furnish a fine spirit of wine.

In order to regulate the temperature of the oven, an iron tube about the size of a musket barrel, closed solid at the lower end, and about a foot long, is suspended vertically in the middle of the neck, by passing through a tapered hole in the top of the latter, whereon the tube rests by its upper end, which is spread out into a conical or bell-mouthed form for that purpose. In this tube oil is deposited, and into the oil is placed the bulb of a thermometer, whose graduated scale above, extending outside of the apparatus, exhibits the temperature of the oil, and, consequently, also that of the oven.

The other modification of the machine described in the specification varies from the preceding in the arrangement of the furnace part. In the first, the fire-grate was *stationary* during the baking; in the second, which we have now to describe, it is made to *revolve.* For this purpose the oven is made circular, and at a suitable distance from the bottom of it, (about a foot,) is a large circular plate of the same diameter as the oven, (six feet,) which turns in a horizontal plane, on a vertical axis, forming a complete partition between the fire place and the ash pit; except in a portion of the circle where the *fire grate* is situated, which is nearly of a sectoral form, to afford a more uniform distribution of the heat, and a greater facility of pushing the grate into, or drawing it out of, its place, under the oven. In order that the air which is admitted into the ash pit to promote the combustion may not be diverted from its proper course, that of passing through the grate on which the fuel is deposited, the patentee

makes the whole circumference of the revolving plate air tight by what is termed an hydraulic joint. Near to the periphery of the circular plate, is fixed a descending rim of three or four inches deep, which dips into a circular trough, filled with water, that rests upon the brickwork surrounding the ash pit; and the revolving plate being wholly supported upon its central axis, the part of the apparatus is rendered as complete in its action as it is simple in form. The motion is communicated to the grate by bevel gear of the usual kind.



The preceding cut affords a sectional view of the last mentioned modification of this baking and distilling machine. *a a* is the iron oven; *b b* the brick floor made level with the bottom of the doorway *c; d* the chamber where the vapours from the bread are collected; *e* the oil tube suspended by its bell-mouthed end in a hole at the spherical extremity of the water chamber; *f* the thermometer with its bulb immersed in the oil contained in the tube; *g* a large aperture through which the vapour escapes into the crane neck, *h*, leading into the refrigerating worm tub, *i*, wherein the vapour becoming condensed is drawn off by the cock, *k*, into a proper recipient. *l l* is the fire place, of which *m* is the grate, resting between ledges on the large circular revolving plate *n n; o o o* are lateral apertures or flues in the brickwork, leading to the general surrounding flue, *p p*, which terminates in the flue, *q q*, leading to a common chimney, not represented in the drawing. *r r r* shows the circular water trough into which the descending rim of the revolving plate dips throughout its circumference. *s s* is the ash pit; *t* the vertical axis of the revolving plate, to which motion is communicated, either by a boy turning the handle *u*, (or any convenient power applied to the pulley *v*,) which actuates the bevel gear W and X. At Y is the register to regulate the admission of air to the fire.

When the thermometer indicates a temperature of 280° Fahren-

heit, the oven is at a proper heat for the baking of bread, during which process, the heat should be maintained at from 280° to 310°, and the vapour drawn off through the refrigerator, for subsequent rectification to obtain the vinous spirit. After the bread has been baked, and the pastry, (as customary,) is introduced into the oven, the action of the condensing apparatus is dispensed with; which is effected by turning the cock at the worm tub, and the oil tube and thermometer being withdrawn, the vapour escapes at the aperture thereby left open. In the baking of biscuit also, which, like pastry, undergoes no fermentation, and, therefore, contains no alcohol ready formed, the vapour is in like manner suffered to escape.

Remarks on the use of Surcharged Steam, with an account of experiments thereon.—By William T. Haycraft, M. D.

The Repertory of Patent Inventions for July last, contains the specification of a patent for improvements in the steam engine, by Dr. Haycraft; and the same number furnishes the following remarks explanatory of the views of the patentee.

The invention described in the accompanying specification, is offered to the public in the full confidence that it is a real improvement on the steam engine, and well worthy the attention of scientific and practical men. I have for many years pursued a series of inquiries on the mechanical properties of steam, especially of what is usually called surcharged steam, i. e. of steam that has been subjected to a higher temperature than that at which it was generated, in which process the steam is increased in volume, with a proportionate increase in mechanical power; the process itself being effected at a comparatively small expense of fuel. In pursuing these inquiries, I have found from the effects of surcharged steam in several experimental engines, that when the cylinder is properly constructed, the power produced is far greater than that from ordinary steam. Encouraged by this success, a 12 horse power engine has been erected, which in its working, has proved the truth of my principles in a most satisfactory manner.

It will, however, be proper, before giving a more full account of this engine, to endeavour to correct some errors which practical and even scientific men have fallen into, concerning steam when applied to produce power, which I shall endeavour to do in the most familiar language the subject admits of.

It is generally supposed, that if steam be heated above the temperature at which it is generated, its force is not increased; that it is even diminished; that the super temperature, by some means or other, kills or destroys its elasticity. I will first endeavour to show how this mistake has arisen.

The following experiment was made by Mr. Perkins, assisted by Mr. Penn, Jr. at his steam engine manufactory at Greenwich, and similar experiments have been made by others.

Surcharged steam was made by passing small quantities of water

through a system of cast iron tubes, heated to a high temperature. This surcharged steam was applied to Mr. Penn's engine of, I believe, 6 horse power; after a short time the engine lost its power, namely, as soon as the cylinder had acquired a super-temperature, although there was abundance of steam.

What could be the cause of this? Most practical men would say that the surcharged steam had lost its elasticity, and, therefore, its power to work the engine. Messrs. Penn and Perkins, however, discovered the fault and endeavoured to remove it. The fault was that as soon as the cylinder became considerably heated, the packings of the piston and piston rod could no longer confine the steam, and it appeared on examination, that these packings had become completely dried, and therefore easily permeable by steam—that, consequently, its force could not be exerted on the piston. To remedy this, the surcharged steam was first passed over the surface of water contained in a second boiler, by which process it rapidly absorbed water till it was saturated, when the engine worked perfectly well. The reader will, however, perceive that in this case, the surcharged steam, by imbibing an additional dose of water, was converted into ordinary steam, which is disposed, when introduced into a working cylinder, to deposit a portion of its water; because the cylinder is of a lower temperature than the boiler. This water, by moistening the packings, renders them, to a certain degree at least, steam tight. The same fact has been observed in condensing engines, when, from the boiler being by accident almost empty, and the fire being urged, so that the upper part of the boiler was extremely heated, and the steam thereby was surcharged. In this case, although there is abundance of steam of the usual pressure, the engine will not do its work.

We had an excellent opportunity of observing this *apparent* want of power in surcharged steam, in an experimental condensing engine. In this engine the steam was surcharged by means of high pressure steam surrounding the cylinder. The piston was provided with metallic plates, which acted well: the piston rod had the usual hemp packing. The engine worked well for some time, until the piston rod had become considerably heated, and its packing dried, when all at once a rushing of air was heard through the packing, and quantities of air were pumped up by the air pump, and the engine lost its power. The power could be restored by moistening the packing, or by pouring in quantities of oil, which latter however passed through with the greatest rapidity.

From the foregoing observations it will appear, that the *apparent* want of power in surcharged steam, is to be attributed to the great difficulty of keeping the joints and packings tight, arising from the disposition which surcharged steam has of drying and injuring the packings.

The experiments from which we some years ago directly proved the *increased* power of surcharged steam, are very simple. They consisted in accurately weighing a copper ball containing steam of the boiling temperature, then by immersing the ball in heated oil, till it attained the temperature of 312°, allowing the surplus steam to

escape by a small orifice, which was subsequently closed very accurately; then by subtracting the weight of the empty ball from the two weights, it appeared that steam surcharged to 100° above the boiling point, weighs $\frac{1}{10}$ of ordinary steam, it being still able to bear the atmospherical pressure; thus one volume is converted into ten volumes, each of which, if its temperature be preserved, will produce a mechanical power equal to the original volume; that is, we increase the whole power ten-fold.

Then the question became, how can we confine this surcharged steam so as to make it available to produce power? We have already seen, that it is from its disposition to dry the packings, that surcharged steam so freely escapes in waste. After a number of experiments with different fluids, my brother and myself found that water, when interposed between the surcharged steam and the piston, was capable of effecting our object. It is well known that water passes through compact organized porous bodies with great difficulty. This is shown in the hydraulic press, in which water under a pressure of several thousand pounds on the square inch, is kept tight by a simple collar of leather. To be assured of the practicability of this to the steam engine, a model was constructed which was so arranged that water could be introduced between the piston and the working steam, or not, at pleasure. When the water was not interposed, there was a waste of steam through the packing at a pressure of 30 lbs.; but when water was interposed, the engine worked perfectly tight at a pressure of above 600 lbs. on the square inch.

Thus we arrived at two important facts; first, that steam is capable, by receiving a super-temperature, of increasing its power in a ratio equal to its increase of volume; and, secondly, that by the intervention of water between the steam and the packing, we are able to make a perfect joint completely impermeable by steam. It would be evident, however, that if water were interposed directly between the surcharged steam and an ordinary piston, it would be soon dried away, and our intentions would be defeated. For the purpose of obviating this, the arrangements as described in the specification, have been made, and the truth of the principles laid down completely put to the test. In an experimental engine, the effect of the surcharged steam is very extraordinary. When surcharged steam is used, the engine does not require one-tenth part of the steam, and what is singular is, that the power of the engine is improved thereby. In this engine, the boiler is not sufficiently large to supply steam of 30 lbs. on the inch, but the moment the steam is surcharged, the steam pressure rises in the boiler till it arrives at 200 lbs., the engine going with its full power the whole of the time, after which the escape by the safety valve is evidently greater than the quantity consumed by the engine. The surcharged steam, after escaping from the engine, is perfectly invisible, so that no appearance of steam can be observed at any time. This shows the extreme rarity of surcharged steam. In the 12 horse power engine that has been erected, we have not attempted to surcharge the steam to so high a degree, for reasons that shall be given, yet its action is equally satisfactory.

There is another point very important to practical engineers, which seems to have escaped the notice of writers on the subject, and was equally unknown to the celebrated Watt, namely, the production of cold *within* the cylinder, occasioned by the evaporation of water deposited on its internal surface. This evaporation takes place every time the vacuum is formed, it of course occasions a production of cold, which in its turn causes a fresh deposition of water, and waste of steam. Although Mr. Watt does not appear to be aware of these series of actions taking place, yet he was perfectly sensible of the great utility of preserving the temperature of the cylinder. For this purpose he used to surround it with steam from the boiler, thinking it to be sufficient to prevent condensation, that the cylinder should be kept at the same temperature as the steam. Had he been aware of the cooling process we have described, he would probably have perceived, that to prevent the evil, it would be necessary to surround the cylinder with steam of a *higher* temperature than that of the working steam; in which case no condensation would take place with the consequent evaporation, cooling of the cylinder, &c. In doing this, however, a practical difficulty presents itself; for if this be attempted in ordinary engines, the water is no longer deposited, and, as we have before shown, the packings become dry, and no longer steam tight. The intelligent reader, on examining the principles of the surcharged steam engine, will perceive, that this drying of the packings cannot take place, although the surcharged end of the cylinder should be raised to ever so high a temperature, the presence of water on the other side of the piston will always effectually preserve them from drying or other injury.

We have sufficient proof of the correctness of these principles in the action of Woolfe's engine. It has been supposed that the saving of fuel in this engine, arises from the use of two cylinders, one of high pressure and the other a condensing cylinder; the escape of the former working the latter, in which arrangement the steam acts by expansion, as it is termed. That the saving is not entirely occasioned by this cause, was shown by an accident which happened in an engine of this description at Mr. Newcomb's mills at Stroud Water. The reader is aware that the condensing cylinder in this engine is surrounded by high pressure steam; now it happened that the high pressure steam jacket was injured, so that the engineer blocked up the pipe leading into it; in this state, the cylinder was no longer surrounded by high pressure steam, of course the working steam was no longer surcharged; the consequence was, that the engine could no longer do its work. The jacket, &c. being repaired, the engine then went perfectly well. In this engine hemp packings are useless, for the reasons given, instead of which metallic pistons are used, which, when the steam is only slightly surcharged, and of a moderate pressure, answers sufficiently well.

There is also a great advantage in using steam of a higher pressure than can be used in engines of the ordinary construction. My brother, Mr. Samuel Haycraft, has found in using high pressure steam, that in increasing the pressure, the quantity of steam expend-

ed is not increased in the same proportion; that, in fact, the quantity of steam expended, is only as the *square root* of the pressure; that is if we increase the pressure four-fold, the quantity of steam required will be only twice as much, by which in proportion to the power produced, there is a saving of one-half: If we increase the pressure nine-fold, the quantity of steam is increased three-fold, by which there is a saving of two-thirds of the steam, and so on in the same proportion. But this cannot be effected to any great extent in ordinary engines, because the packings are not sufficiently tight at high pressures. But we have shown, that by means of the arrangements proposed in our improvements, our packings are able to sustain a pressure of more than 600 lbs. on the square inch, without leakage. It is by a combination of the principles of working high pressure and surcharged steam, that the greatest advantage is to be derived: thus, we found in the experimental engine, working at 200 lbs. pressure on the square inch, with surcharged steam, the expenditure of steam was only one-tenth of the quantity used, when unsurcharged steam of 30 lbs. on the inch was used: thus the power compared to the quantity of steam, was increased more than sixty-fold, the engine working perfectly tight.

The 12 horse power engine referred to, has been constructed agreeably to the plan laid down. The boiler is of a size usually adapted for a 4 horse power engine, and it works the engine at its full speed, and at a full power of twelve horses, calculating 220 lbs. pressure on the piston for each horse, exclusive of friction. The boiler evidently makes more steam than is necessary, the steam constantly escaping by the safety valve, when the engine is going at its full power, although the fire is kept low, and the boiler is only set in a temporary manner, with a very short chimney. The engine also works under the disadvantage of being completely exposed to the open air. The boiler is of the strongest form, being a cylinder twenty-six inches in diameter, and ten feet long. It is made of the best forged iron; and has been proved to above 500 lbs. on the square inch. This engine is computed to consume one-half a bushel of coals per hour, being about one-half of the quantity required in a Woolfe's engine of the same power.

In this engine we have not attempted to carry the surcharging and high pressure to its greatest extent, as without so doing, the effect sufficiently answers our expectations, and the saving of fuel is so great as to make any further saving, at least in a fixed engine, of comparatively small consequence.

But the superiority of this engine is not confined to its saving in coals, for it is evident that its saving in water is still greater. When we consider that in all engines, and especially in high pressure ones, a great quantity of water is thrown up from the boiler into the cylinder with the steam, which has been estimated by practical men to be full one-half of the whole quantity used, we shall perceive that as by the surcharging plan the whole of the water is converted into steam, the saving of water will be twice as great as the saving in steam. Now the saving in steam is, on the lowest calculation, *com-*

pared with ordinary high pressure engines, three-fourths of the whole quantity, the surcharged steam engine requiring only one-fourth of the coals, will require only one-eighth of the water. In applying this to the subject of locomotive engines, we will consider it in the following way:—First, the load required for supplying the engine, consists of one part of coals to six parts of water, because one pound of coals will boil off six pounds of water. Therefore, if we suppose the load necessary to supply the engine, to be two tons, the weight

of the coals would be - -	Cwt.	5	2	24
The weight of the water, - -		34	1	4
	Cwt.	40	0	0
By the use of the surcharged steam engine, the quantity of coals will be - - -		1	1	20
The weight of water - - -		4	1	4
		5	2	24
So that there would be a saving of the load required, equal to - - -	Cwt.	34	1	4

The great advantage of lessening the load in a locomotive engine, especially if intended for the road, is self evident; it will in effect be increasing the power of the engine, and of course the velocity of the carriage. Also, by thus lightening the load necessary for the engine, we shall be able to carry such an increased supply, that we shall be enabled to travel three or four times the distance without fresh loading. We shall also be able to increase the *steam power* to a great extent.

It must be familiar to the reader, that the two obstacles to the complete success of locomotive engines on the common road are, the want of steam power adequate to the load required, and the too frequent necessity for stopping to take in a fresh supply of water and coals. These two obstacles the surcharged steam engine will completely remove.

The surcharged steam engine may also be made more compact in its form than any other, arising chiefly from the smallness of the boiler, or generator, required.

It should also be observed, that this estimation of the saving of fuel and water, is on the least favourable scale. I have shown, that by combining a considerable steam pressure, (200 lbs. on the inch,) with completely surcharging the steam, the power produced was increased sixty-fold, compared to that produced by an equal quantity of steam not surcharged. This almost incredible effect was produced by the application of a moderate fire directly to the surcharged part of the cylinder. This engine has been frequently worked in this manner for several hours during many months, yet, although the cylinder is of brass, it was never in the least injured by the fire; also the piston packing and the other joints were always perfectly tight. Even should it be apprehended, that in the course of time, the cylinder might be injured, that part of it which is exposed to the fire may be

replaced in a few hours, by a new spare piece, without in the least disturbing the working part of the cylinder, piston, &c. On this plan, the saving of steam may be carried on to an almost unlimited extent.

The only objection of moment which has been made by the many practical men who have seen the engine is, that owing to the large size of the piston rod, which, in fact, may be considered as a second piston, there is an increase of friction. This is certainly true, but at the same time, the advantages arising from the arrangement are so great, and the power is so much increased, that it must be considered in the same light as Watt's addition of the air pump to the condensing engine, which although from its friction, &c. it requires some power to work it, yet at the same time, it adds so much more power to the engine, that, on the whole, it is a real improvement. From the small size, however, of the cylinder in this engine, it is evident that its friction must be less than that of a condensing engine.

Many also object to the use of high pressure engines, from a mistaken idea of the danger attending them. Perhaps, on the whole, however, they are even safer, owing to the greater precaution used in having a boiler or generator of the greatest possible strength. In the engine we have erected, the boiler has been proved to above 500 lbs. on the square inch, so that it would require an error of more than 400 lbs. on the square inch to render it unsafe, which error can hardly happen: on the other hand, few low pressure boilers would be safe at a pressure of 25 lbs. on the inch, so that an error of 20 lbs., should the safety valve be obstructed, would be dangerous. In the surcharging engine especially, the boiler is so small, that its safety is secured. The reader is aware that Woolfe's engine, as improved by Mr. Hall, works with a high pressure boiler, yet its working gives general satisfaction. The surcharged steam engine may indeed be considered nearly the same in one of its principles with Woolfe's, namely, the working with surcharged steam, excepting that in the latter, the steam is only very slightly surcharged. In our engine, the steam is completely surcharged, and the full advantage of the principle is thereby obtained. Woolfe's engine also, being on the condensing plan, cannot of course be used for locomotive purposes, and from its being somewhat complicated, perhaps is not quite so well adapted for navigation; although for mills, &c. it is the best engine hitherto known. The surcharging engine, from its compactness, its great saving in coals and water, and its increased power, is peculiarly adapted for these purposes, and I have but little doubt but that its use will eventually become general.

To express in a few words the principal feature of the surcharged steam engine, we would say, that it accomplishes the important desideratum of having a perfectly steam tight piston packing. It should be recollected, that it was the opinion of the celebrated Watt, that the chief cause of the waste of steam in the steam engine, is the want of tightness in the piston; and it is known that he laboured many years in endeavouring to effect this object. Since that time, it has

been attempted by many of the most skilful engineers without success.

The other feature is, that by means of a prolonged piston or plunger, there is a complete separation between the surcharged end of the cylinder and its working part, by which means, the steam can be worked in a completely surcharged or rarefied state, and the piston, being also covered with water, is effectually preserved from injury.

Remarks on the construction and peculiarities of the four Engines employed at the competition for the prize given by the Liverpool and Manchester Rail-way. From Wood's Treatise on Rail-roads. New edition, 1831.

TABLE.

Names of Engines.	Area of fire grate in feet.	Area of *radient* surface in feet.	Area of *communicative* surface in feet.	Cubic feet of water evaporated per hour	Lbs. of coke required to evaporate a cubic foot of water.
Rocket . .	6.	20.	117.8	18.24	11.7
Sans Pareil	10.	15.7	74.6	24.	28.8
Novelty .	1.8	9.5	33.		
Old Engines	7.	11.5	29.75	15.92	18.34

In examining the above, we find a very important effect in the economy of fuel, produced by the Rocket over the old engines, in the proportion of 11.7 to 18.34, supposing the heating powers of coke and coal to be equal. The cause of this is very obvious, and is entirely attributable to the use of the tubes of small diameter, presenting such an area of surface to the water in the boiler. These tubes were used at the suggestion of Mr. Booth, treasurer to the Liverpool and Manchester Rail-way Company, and nothing, since the introduction of those engines, has given such an impulse to their improvement.

With a less area of fire grate than the old engines, the surface exposed to the radiant heat of the fire is as 20 : 11.5, and the surface exposed to the communicative power of the heated air and flame, as 117.8 : 29.75, nearly four times as great.

Nor is this the only difference; in the old engines, the *area* of the tube, (of 22 inches diameter,) for the passage of the flame and heated air to the chimney, was 380.13 inches; and of this large body of flame and air passing through the tube, only an extent of surface of 69.11 inches, was exposed to the water in the boiler. In the Rocket engine, the area of heated air and flame in 25 tubes, 3 inches each in diameter, was 176.7 inches, while the surface exposed was 235.6 inches.

It is not necessary, perhaps, to pursue the comparison further.

The economy of fuel which must result from the exposure of so much greater surface to the water, cannot fail to ensure a more perfect abstraction of the heat, and thus not only save the fuel, but prevent great part of the previous destruction of the chimney, by the intense heat of the *wasted* caloric.

The same remarks apply to the Sans Pareil of Mr. Hackworth, as to the old engine, though in a less degree. In the Rocket, the surface exposed to the radiant heat of the fire, compared with the area of fire grate, is as $3\frac{1}{3}:1$, while in the Sans Pareil it is only $1\frac{1}{2}:1$; the same proportion as in the old engines. In the Rocket, the surface exposed to the heated air and flame, compared with the area of fire grating, is as $19\frac{2}{3}:1$; while in the Sans Pareil, the proportion is only $7\frac{1}{2}:1$. The bulk of air passing through the tube of the latter, will, at its exit into the chimney, be 176.7 square inches, the exposed surface being 47.12, or, 25 : 1, nearly; while, as before stated, the bulk of air passing through the tubes of the Rocket, is 176.7 inches, or precisely that of the Sans Pareil, while the surface exposed, is 235.6 inches, or $1\frac{1}{3}:1$. These will sufficiently account for the great difference in the economy of fuel between the two engines; the Rocket requiring only 11.7 lbs. to convert a cubic foot of water into steam, while the Sans Pareil required 28.8 lbs.

Some explanation is, perhaps, necessary, why the Sans Pareil should, in this respect, be more extravagant than the old engines, while the extent of surface, compared with the area of fire grate, is much greater, and therefore should exhibit a more economical result: and this explanation is the more necessary, as, though not appearing at first sight, it involves a principle of the greatest importance in the economy of those engines; and which, if not acted upon, would render the use of the tubes, however otherwise valuable, considerably less effective.

It will readily occur to any one, paying a little attention to the matter, that the system of tubes may be carried so far, as to reduce the temperature of the flame and heated air, nearly equal to that of the water in the boiler; in which case, when it reaches the chimney, it will be incapable, from its reduced temperature, of producing a sufficient draught of air through the fire grate. This would prevent all the advantages being taken of the refracting powers, which would otherwise result from the use of these tubes. It is stated, in another part of this work, that on the introduction of those engines, it was necessary to resort to the application of the waste steam thrown upwards into the chimney, to create a sufficient current of air through the fire; which was afterwards laid aside, or only partially used, when only slow rates of speed were required.

Mr. Hackworth had, it appears, in his engine, resorted to the use of this in a more forcible manner than before used, throwing it up as a jet, and which, when the engine moved at a rapid rate, and the steam thereby almost constantly issuing from the pipe, had a most powerful effect.

This, though effecting the object for which it was intended, being carried too far, partly in consequence of the rapid speed at which

the engine was made to travel, was productive of another evil, which, though operating fatally so far as regarded that particular experiment, was capable of easy remedy.

The consequence was, that when the engine began to travel at the rate of 12 or 15 miles an hour, the draught was so great, that it actually threw the cinders out of the chimney with considerable force, producing a destruction of fuel enormously great, so much so, that the consumption was at least 692 lbs. per hour.

The area of fire grate of the Sans Pareil, was 10 feet; supposing that the area of the fire grate of the Rocket had been the same, the consumption of the latter engine, with its power of exhaustion, would only have been 361 lbs.; showing that the force of draught was so much greater in the Sans Pareil, as to consume nearly twice the quantity of fuel in the same time.

This will satisfactorily account for the apparent anomaly in the consumption of fuel with this engine, compared with that of the old engines, having a single tube; otherwise, though not likely to have come up to the Rocket in point of economy of fuel, we should have expected an effect considerably greater than in the old engines. The combustion of the fuel being so very rapid, and the abstracting surface so small, the heated air would pass off at a very high temperature; thus accounting for the loss of effect.

The knowledge of this fact,—or rather, availing ourselves of this power for the purpose of creating a draught in the chimney,—leads us to an inquiry of great interest. By an extension in the use of these tubes of small diameter, there is little doubt of our being able, (supposing we can force the necessary quantity of air through them,) to reduce the temperature of the heated air, before its exit into the chimney, nearly equal to that of the water in the boiler. This would be abstracting all the useful heat, and probably effecting all the economy of which the fuel is susceptible.

Perhaps it would not be adviseable to carry it quite so far as this; for when the temperatures become nearly equal, the abstraction of heat would be so slow, as to require a greater length of tube than it would be convenient to employ. We may, therefore, suppose, that in all cases, the temperature of heated air passing into the chimney, will be greater than that of the water in the boiler. The heat will, however, be insufficient, in engines of this kind, to cause a sufficient quantity of air to pass through the fire for the purpose of combustion; and it becomes a question, whether we should allow a portion of the heat to escape for that purpose, or, by contracting the exit of the escape of the steam from the cylinders into the chimney, to effect the same object.

Whether the last method is the most economical or not, though there is every reason to suppose it is, perhaps it is the only one with these engines that is suitable for their action upon rail-ways, especially for quick travelling. The performance of those engines depends entirely upon the quantity of steam they can raise in a given time; and when travelling at the rate of fifteen miles an hour, or upwards, the production of steam is required to be very rapid indeed:

the mode of producing a proper draught through the fire, by throwing the steam into the chimney, after its passage through the cylinders, is, perhaps, therefore, the best; as the quicker the engines travel, and when, consequently, the necessity for steam is the greatest, the then rapid and almost continuous exit of the steam into the chimney, increasing in proportion to the increased speed of the engine, produces, at the same time, a correspondingly greater quantity of steam.

In the "Rocket" engine, this mode of increasing the draught of the chimney, was but partially used; the steam was made to pass into the chimney, by two pipes, one from each cylinder, and the size of the aperture was not, therefore, sufficiently small to cause the steam to pass into the chimney with adequate force; still, in that engine, we find it only required 11.7 lbs. to evaporate a cubic foot of water,—36 per cent. less than with the old engines. We shall afterwards find, that this has been considerably more reduced in the engines lately made.

The "Novelty" engine is on a different principle from those previously considered, the necessary supply of air to the fire, being produced by a bellows. In this case, a chimney becomes unnecessary, and from the way in which the Novelty is constructed, the air was forced through the fire in a very condensed or compressed state. The area of fire grate being little more than one-third of that of the Rocket, and the surface exposed to the radiant action of the fire, less than one-half the temperature to which the fire was raised, must, of course, be considerably greater, to evaporate an equal quantity of water in the same time. The abstraction of heat would be probably more perfect in the Novelty, for the tube through which the flame and heated air passed in its exit to the atmosphere, was 36 feet in length, in one tube; whereas, in the Rocket, there was the same length, though subdivided into six tubes. It is, however, extremely questionable, whether one tube 36 feet long, or 6 tubes, each 6 feet long, *of the same sectional area*, are most preferable: the latter would, of course, give a much greater exposure of surface. The area of exit of the heated air, into the atmosphere, of the Rocket, was 25 times that of the Novelty; from which we may imagine the degree of compression necessary to force the same quantity of air through the fire; though we do not say, that to raise an equal quantity of steam, an equal quantity of air, in that highly compressed state, is necessary.

It was much to be regretted that the experiment with the Novelty could not be continued sufficiently long to ascertain the power of raising steam, by this method; the inquiry was of the utmost importance. Theoretically considered, we are of opinion, that this mode of generating steam, is more economical in point of fuel, than in engines, the combustion of the fire of which is kept up by the rarefication in the chimney; but there are practical objections to set against this, of which, the destruction of fire bars, and the power required to work the bellows, are not the least. We say theoretical, because, suppose two generators, the area of the grate bars, extent of radiant and communicative surface, are in both the same, except the area of

exit pipe into the chimney, which with the generator worked by the bellows, is *one-half of that* by exhaustion of the chimney. If the same quantity of air pass through the grate bars in each, that with the bellows, will necessarily be of a more compressed state, to force the same quantity of heated air through the narrow exit; and this compressed state of the heated air will, of course, cause more of the caloric to be abstracted, than in the other case; for we suppose the temperature reduced to the same, in both cases, in the exit pipe. For if the heated air, in both cases, pass into a chimney of the same area, and equal to that of the exit pipe from the generator, on the exhaustion principle, the temperature of the heated air being supposed to be the same, in both cases, in the exit pipe, the heated air from the generator with the bellows will, therefore, have to expand itself in the chimney into twice its volume, which will, of course, reduce its temperature below that of the other; thus proving a more complete abstraction of the heat. The only question is, whether the disadvantage in practice, consequent upon the operation of such a principle, does not counterbalance any advantage gained in the economy of fuel; and this we must leave to experience to determine.

The question between the two modes, however, assumes a new character, since the application of the steam from the cylinder to create a current of air in the chimney; as in that case we can, by the use of a greater number of smaller tubes, reduce the temperature so low, until, if adviseable to do so, it is equal to that of the water in the boiler. And it then becomes a subject of inquiry, which of the two modes occasions a greater loss of power in obtaining the necessary current of air; the working of the bellows, in the one case, or the loss of power by the obstructed passage of the steam into the chimney, in the other.

It is, perhaps, necessary, after the above disquisition, to explain, so far as we are able, the cause of the failure of the Novelty engine at the Liverpool experiments, to show that it arose from no defect in the principle, but only in the construction of that engine. It will be seen by the sketches of this engine, that the flame and heated air, after leaving the fire, passed through the winding pipe of the horizontal generator. The generator was only 12 inches diameter, and there were three folds of the flue tube within it, in diameter from 4 inches at one end, to 3 inches at the other; very little space was, therefore, left between the flue tube and the top of the generator. The temperature of the flame, within this tube, when the engine was running at a quick rate, would be very great, especially where it left the upright generator; and the evolution of heat would therefore be so rapid, that the passage of steam out, would prevent the water from flowing along this horizontal generator; and the consequence was, that the flue tube got dry, and either collapsed with the heat and pressure, or gave way at the joint. This, it will be seen, however, arises from no defect of principle, and was easily remedied.

[*Rep. Pat. Inv.*

On the Law of Patents, as it exists in England.

We copy the following article from the London Journal of Arts and Sciences; as it contains many remarks applicable to the patent law of our own country, although particularly directed to that of England. From many of the defects of the English statute, and the practice under it, we are fortunately exempt; it is, however, universally acknowledged that the laws of the United States upon this subject are susceptible of great improvement.

We have been favoured with a copy of a small pamphlet, written by Mr. Richard Roberts, of Manchester, on the subject of our existing Patent Laws, with his views as to the best mode of amending them. This little work contains many valuable and judicious remarks upon this important subject; and as the pamphlet has only been privately circulated within the circle of the author's immediate friends, we have taken the liberty of making a few extracts, which we have no doubt will be acceptable to our readers.

It is acknowledged that mechanical inventions and improvements are beneficial to the public, and as men cannot be compelled to give their inventions or improvements to the public gratuitously, it is expedient to induce them to do so, by the hope of a due reward.

This reward is given in the least objectionable shape by granting to the inventor or improver, a patent of monopoly for a limited period; at so moderate a rate of charge as may put it in the power of such parties as are the most likely to invent or improve, to avail themselves of the monopoly.

A high rate of charge for a patent amounts in effect to a prohibition from taking one out, as it regards a large portion of those who are most likely to make discoveries: high charges, therefore, so far defeat the objects for which patents are granted, as they tend to check invention, and to cause to be withheld from the public, that which it is desirable the public should be possessed of.

No evil can arise from an increase in the number of patents taken out; because, if the discovery be worthless, the public is not injured; and if it be valuable, the greater the number of valuable discoveries made known, the more is the public benefitted.

Patentees, in general, are not likely to be over rewarded. Some few may be eminently successful; but, from the delay and expense of experiments, and from a disinclination in society to depart from established practices, a large proportion of them will either gain but little, or will even sustain loss. But, whether the patentee be rewarded or not, the public will be benefitted, if the invention patented be a valuable one.

Patents ought to be cheap; because the granting of a patent is merely recognising in an inventor, his property in his own invention for a limited period, on condition that he shall afterwards give the invention to the public; for, without his consent, no other person can avail himself of it.

Any sum charged for a patent, beyond its actual cost to the nation,

has the effect of a tax on inventions; which must be paid, whether the thing taxed be saleable or not.

Whilst patents are expensive, the men most likely to make discoveries, (managers, foremen, and working mechanics,) are unable to obtain them: consequently, their inventions will, in but comparatively few instances, be made public; and, even in those instances, it will be by the inventors sacrificing to others a large portion of their own interest, in order to secure the remainder.

The expense of making experiments, and of specifying inventions, is so great, as frequently to leave a man, after such expenditure, but little wherewith to obtain a patent: and if he begin by taking out an expensive patent, he may thereby be deprived of the means of making the requisite experiments and of specifying. In the former case, when his experiments precede the taking out of the patent, being through its high price incapacitated from securing a legal protection for his property, he is obliged to abandon the invention: whereas, under the same circumstances, a cheap patent might have put it into his power to benefit both himself and the public. In the latter case, when the taking out the patent precedes the experiments, the title of the patent gives to the public some knowledge of the invention; but, not being sufficiently matured, from want of means, it is rendered valueless both to the inventor and to the public. A dread of either of these results deters many persons from applying for patents.

Men of property who have had experience in the results of machinery, will not often be induced to risk their money in expensive patents; knowing, as they do, that before any profit can be realized, beyond the cost of experiments and of the patent, many years generally elapse; during which time there is considerable risk of the invention being superseded.

Many valuable machines are invented, which from various causes cannot be brought into profitable use for a great number of years. Few inventors of such machines can afford to pay a high price for patents.

A cautious man will generally take a considerable time, perhaps years, to decide whether or not he will risk the large sum now required for a patent; during which time the public loses the benefit of the invention.

Many things of a comparatively trifling nature are invented, which, were a cheap patent obtainable, would get into extensive use, and thereby benefit the public; but, when the inventor will not risk the large sum now required, the benefit of the invention is lost to the public, as well as to himself.

The early introduction of a useful invention or improvement is always of consequence to society, and therefore ought to be encouraged by the granting of cheap patents.

Patents, if cheap, would be taken out for many inventions, individually of little value; by which the patentee might possibly sustain loss, but the public would be benefitted. Besides, many of such inventions would either suggest a new idea, or by calling the attention of mechanics to what was looked upon as desirable, be the indirect

cause of a further beneficial invention or improvement. This is proved to be the case in countries where patents are cheap, as an examination of the list of patents, especially in France, will testify.

By an increase in the number of patents obtained, greater publicity would be given to the most approved machines, or modes of operation, previously in use; for, as the greater number of inventions are for improvements in old machines, or modes of operating,—and it is requisite to describe much of the old machine, or mode, in order to explain the new invention,—the public would thus become acquainted with many mechanical combinations and processes of art, which probably were previously but little known.

By the encouragement which cheap patents would afford, many valuable inventions and discoveries would be published, through the patent office, which otherwise would either die with the inventor, or make their way to the public very slowly. The following inventions may be considered to be under this predicament.

The discovery of a principle, any practical application of which does not immediately present itself to the discoverer; or the means of making which application may not be then at his command.

The discovery of a mode of producing an original screw, of greater accuracy than can be produced by any known mode.

The discovery of a mode of dividing straight lines or circles, in a more simple and accurate manner than any hitherto known.

Discoveries of this nature, notwithstanding their importance to society, could seldom be profitable to a patentee; but still, if a patent were cheap, the discoverer would obtain one for the mere chance of remuneration; and at the same time to gratify his laudable ambition to be recorded as the inventor: and in this way, by the publication of the invention, society would be benefitted.

If a machine is intricate, and one machine, or one establishment with a given number of such machines, would be capable of supplying the demand of an extensive district; the inventor, rather than incur the risk involved in the obtaining of an expensive patent, with the view of remunerating himself by the grant of licenses to use the invention, will depend upon his power to keep the invention secret, and to benefit himself by the sale of the product of the machine.

There are many inventions to which the inventor, for various reasons connected with his regular business, cannot devote the time requisite for bringing them into operation; but he would risk a small sum for a patent if the invention afforded him reasonable hopes of remuneration by the sale of it.

If a man have a number of inventions, and if patents were cheap, he would take out a patent for each, giving to it a clear and definite title; whereas, under the present expense of patents, that cannot be afforded: and persons frequently wait till they have made several inventions, and then, that one patent may cover them all, they make out a very sweeping title. Thus the public is often deprived of the benefit of inventions for years.

An inventor often discovers, after maturing his invention, that the title is not correctly applicable to it; and in such cases, if patents

were not expensive, a new patent would frequently be obtained with a title more appropriate.

The number of inventions imported would be more considerable if patents were cheap.

A patentee will often find it impossible to make a sufficient number of experiments to enable him to draw up a good and valid specification of his invention in time for enrolment to save his patent. In such a case, neglecting to give in any specification, he would, if he could obtain a patent for a small sum, take out a new one; unless in his former title he had already exposed too much of his invention.

Patents for Principles.

As the objects of granting patents are to benefit the public and to reward inventors, patents should be granted for all discoveries, of which the public had not any previous knowledge; for it is not reasonable to expect that persons will communicate their discoveries without some probability of being rewarded.

Many of the gentlemen who gave their evidence before the committee of the House of Commons, in the session, 1828, were of opinion that no patent ought to be granted for the discovery of a principle, unless the discoverer specified some mode of rendering the new principle useful to the public; and in that case, it may be presumed, they were of opinion that every application, of which the new principle should be found capable, ought to be secured to him, however inefficient his mode of applying it might be.

If such a plan is to be acted upon, it may require two distinct discoveries, the offspring of very different talent, to entitle to one patent. For instance,—a man may discover a new principle, yet, from the nature of his previous pursuits, he may be a very unlikely person to invent any apparatus, by which his new principle may be made useful to the public.

Before proceeding further, it may be proper to observe, that the word "principle," as applied to the arts, may be defined to mean any particular law or action of nature, by which two or more bodies influence each other, to produce some certain result; or, that particular kind of action by which any thing is characterized.

New principles may be discovered by persons who do not see any useful application of them; yet, as soon as they are made known, such application is quickly made by others.

If the discovery of the magnetic principle had not been communicated, the mariner's compass might never have been invented.

If the first person who discovered that steam is capable of exerting great expansive force had obtained a patent for that discovery, and thereby given publicity to the fact, it is probable that amongst the numbers who would have attempted to render such force available for useful purposes, some one would have been successful; and that the steam engine and many other inventions with which the force of steam is connected, would have been employed beneficially some centuries earlier.

Publication of Patents.

All specifications of patent inventions should be officially published at as early a period after they are lodged in the patent office as their nature will admit of, in some work to be established for that purpose, which should be published, say once or twice a month. The work might be designated "The Official Record of Patent Inventions."

The following reasons offer themselves in favour of such a mode of procedure:—

That patent inventions may be well advertised amongst the persons most interested in them.

As a trade may have a new direction given to it, or may be entirely destroyed by a new discovery or invention, extensive publication is desirable, that parties interested may regulate their future proceedings accordingly.

That parties interested may be well informed what the claims of a patentee are; and thus have an opportunity to set his patent aside if he be not fairly entitled to it.

From the claims of a patentee being extensively known, infringments would be more likely to be detected.

Much time would be saved which is at present devoted to the prosecution of supposed new inventions, but which have before been patented. There would also then be fewer instances than occur at present, of two or three patents being granted, at nearly the same time, for the same object.

Persons requiring office copies of specifications, for legal or other purposes, would be spared the great expense whicn is at present incurred; and much valuable time would be saved which is now spent in going to the office to examine specifications.

That patentees may not be injured by the destruction of their specifications, by fire or otherwise.

In specifying improvements it is generally necessary to specify the thing improved; consequently the readers of the "Official Record," would be made acquainted with the old machines, or other matters, as well as with the improvements.

Defective Specifications.

Much has been said before the Committee of the House of Commons, about defective specifications being lodged by patentees, who were desirous of concealing from the public the real nature of their discoveries.

With respect to *mechanical* inventions it does not seem probable that many persons will attempt such concealment, since the invention is of necessity exposed by the sale of the first machine.

In *chemical* discoveries, the case may be different; and if some mode of inducing a patentee to amend his defective specification could be devised, without introducing a greater evil than now exists from an occasional defective specification, perhaps it would be de-

sirable to adopt it But nothing would tend more to put a patentee on his guard against making a defective specification, of either a mechanical invention or chemical discovery, than the knowledge, that his own workmen or others may become aware of, and expose those defects, whenever his specification is published in the manner recommended.

On the comparative durability of Cast and Wrought Iron, when used on Rail-roads. Extracted from the new edition of Wood's Treatise on Rail-roads.

We now come to the question of comparative durability between cast and malleable iron rails. The introduction of the latter being comparatively recent, the opportunity to subject them to the test of experiment, has not existed sufficiently long to produce any very conclusive decision from that source: the opportunities of doing so, are also not numerous; and many people are more disposed to concur in, and yield to, the general or current opinion, than either to wait the result, or submit to the tedious operation of experiment. In this case, also, no experiment can be decisive unless acted upon for a number of years: we are, therefore, almost obliged to act upon speculative opinion, until sufficient time has elapsed to produce conclusive evidence in favour of either mode.

Independent of economical considerations with respect to the durability of wrought iron rails, their safety, compared with cast iron upon public lines of road, has already almost produced a general concurrence in their favour: and therefore, perhaps, the question of durability becomes of less importance. Still, as in some cases, where rapidity of transit is not necessary, relative economy may become an object; we shall therefore adduce such as our experience enables us, of the comparative durability of cast and wrought iron.

Experiments are going on at present, where both kinds of rails, accurately weighed are laid down, and subjected to the passage of the same quantity of traffic over them: the result of these, so far as they have gone, are in favour of wrought iron. In the operation of making the cast iron rails, the surface is partially case-hardened in the casting: this may be seen in all cast iron rails extending to a certain depth from the surface; any experiment showing the comparative wear, must, therefore, be continued until after the outer hardened surface be worn through; and it is presumed that sufficient time has not yet elapsed to furnish this. We have therefore been obliged to reject the data founded on this mode of experimenting, and shall give the result of a different sort of test, more severe, and which, it is trusted, will be deemed sufficiently approximate to justify its presentation to the reader.

Upon the Killingworth rail-way, we had originally common cast iron wheels upon the locomotive engines; about four years ago we adopted wrought iron tires; now, as we have in this way the relative wear of cast and wrought iron upon the wheels which run upon the

rails; and as the nature of the action will operate nearly alike, whether upon the surface of the rails, or of the wheels, we shall by that means have a pretty near approximation to the relative wear upon the rails. In this way, we have a considerably more severe test; as, if we take the quantity of traffic equal to 2000 tons passing along the rail-way daily, and suppose the carriages to convey 3 tons each, with 3 feet wheels, the relative wear of the wheels and rails are as 53 : 1 nearly.

The average wear of the cast iron wheels was above $\frac{1}{2}$ inch in 9 months; and with the wrought iron tire, the wear of one pair of wheels has been $\frac{1}{4}$ inch in 3 years, and with three other engines, $\frac{1}{8}$ inch in 12 months; making the wear at least as 5 to 1 in favour of wrought iron.* The actual wear of the rails will not be to the same extent as this, as the engine wheels sometimes slip round, or slide upon the rails in bad weather. The wear of the wheels of the common carriages will not be so much for the same reasons; but although it should be observed, that from this we ought not to deduce the actual duration of wrought iron rails, as, their surfaces being narrower than the wheels, the wear will be, perhaps, more than proportionably greater; yet the relative wear should, however, remain the same.

The very great difference of wear in the wheels, proves, beyond any doubt, that if rails of the proper degree of strength be used, the durability must be decidedly in favour of wrought iron rails; and we have before observed that practice has shown, that in rails properly manufactured, none of the exfoliation, lamination, or oxidation originally dreaded, exists.

The next inquiry is, whether the resistance is greater upon wrought than upon cast iron rails. As in the case of the cast iron, when first introduced, the wrought iron rails were made far too slight; and observation showed that to a certain extent, the resistance appeared greater than upon cast iron; and this, as may be supposed, was owing to the bending.

To ascertain if such was the fact, to what extent, and to what strain they could be subjected without increasing the resistance, the following experiments were made.

Two lengths of rails were laid down upon balks of wood, one of

* The following is a memorandum of the duration of wrought and cast iron rails on the Stockton and Darlington rail-way.

Malleable iron rails, 15 feet long, over which locomotive engines pass, weighing from 8 to 11 tons. Wagons and their loads, 4 tons each.

86,000 tons passed over in a year, exclusive of engines and wagons.

Weight of rail, 1 cwt. 26$\frac{1}{2}$ lbs.

Loss of weight in 12 months, 8 oz.

Cast iron rails, 4 feet long, over which wagons only pass, weighing 4 tons each when loaded.

86,000 tons passed over in a year, exclusive of wagons.

Weight of rail, 63 lbs.

Loss of weight in 12 months, 8 oz.

The loss of weight in malleable iron rails, when wagons ONLY passed over, was, in the same period, 8 ounces for 15 feet length—the same quantity of goods, 86,000 tons.

cast, and the other of malleable iron, both of which were taken off the rail-way in their working, and brightened state. They were laid down close to each other, upon the same balks, and a pair of wheels resting on one could be readily lifted upon the other: two wheels joined together by an axle, and taken from one of the carriages in use, were then placed upon one of the lengths, and loaded on the lower side of the rim with weights, that could be varied at pleasure: the wheels thus unequally loaded, became like a pendulum, by the centre of gravity being thrown near the periphery on one side; and they would of course only remain at rest, when the line of gravity passed through the centre of the axle joining the two wheels, and that point of the periphery resting on the rails: the wheels were then rolled along the rails, until the centre of gravity was several inches beyond the point of bearing, and when let go, it of course vibrated backwards and forwards, until the resistance of the periphery upon the rails brought it to rest.

This mode of experimenting was preferred to trying the relative resistance by carriages; as, in this way, there was no action except that of rolling; and by lifting the wheels alternately from one kind of rail to the other, without altering the weight, the comparison became very delicate. A scale was used to measure the extent of each vibration from the centre, and the observations made by a telescope: the number of oscillations were thus counted, while the extent of the vibrations were diminished each inch. Thus, at the commencement, the extent of the vibrations from the point of rest was 5 inches; and the wheels made 56 vibrations before this was diminished an inch, or until the extent of vibrations from the centre was 4 inches. The cast iron rails were 3 feet 9 inches long, and weighed 56 lbs.; section shown in Fig. III. Plate II. The wrought iron rails weighed 28 lbs. per yard, the bearings 3 feet apart; section same as experiment II. on the strength of rails.

EXPERIMENT I. EXPERIMENT II.

Extent of Vibrations.	Weight of wheels, &c. 10 cwt.				Weight of wheels, &c. 20 cwt.			
	Cast iron Rails.		Wrought iron Rails.		Cast iron Rails.		Wrought iron Rails.	
	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.
in. in.								
5 to 4	56	62	54	64	52	50	52	52
4 to 3	74	78	68	80	64	70	64	66
3 to 2	88	22	84	100	84	82	92	86
2 to 1	87	86	98	84	99	110	142	150

Extent of Vibrations.	EXPERIMENT III. Weight of wheels, &c. 30 cwt.					EXPERIMENT IV. Weight of wheels, &c. 40 cwt.					
	Cast iron Rails.		Wrought iron Rails.			Cast Iron Rails.		Wrought iron Rails.			
		Wedged.			Wedged.		Wedged.			Wedged.	Wedged.
	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.	No. of vib.
in. in.											
7 to 6	—	—	—	—	—	28	30	24	26	31	32
6 to 5	—	—	—	—	—	32	34	28	28	32	32
5 to 4	54	46	54	54	50	42	36	38	38	35	35
4 to 3	66	56	70	66	68	44	48	44	46	43	45
3 to 2	82	78	90	94	90	48	46	56	55	50	48
2 to 1	94	90	116	124	114	52	52	84	82	63	66

These experiments will show that the resistance was the same with malleable and cast iron rails, until the incumbent weight reached 30 cwt.; with 40 cwt. the number of vibrations from 7 inches to 3 inches, in cast iron, was 146; while upon wrought iron, it was 134 and 138 respectively; showing a trifling increase of resistance with that weight. The rails were then wedged up on the under side to prevent them from bending, when the number of vibrations of cast iron was 148; showing that scarcely any resistance was owing to the want of stiffness. With the wrought iron, the wedging had an increase of effect, and brought up the resistance nearly equal to that of cast iron; and thus proving, that when no bending takes place in the wrought iron, the resistance is precisely the same as with cast iron.

We, however, find by these experiments, that the rails of wrought iron, upon which these experiments were made, were only sufficient for carriages of four wheels, weighing three tons. The deflection with 30 cwt. was .032 inch, with 40 cwt. .043 inch; so that we find it will not be adviseable to use rails, the deflection of which, when loaded, amounts to .032 inch, especially when the rails are laid down of this strength; as when they become worn, the deflection being greater, an increase of resistance will take place. With carriages mounted upon springs, which yield to all the inequalities, and want of parallelism of the road, we may suppose the whole weight of the carriage divided equally upon the four wheels. But with carriages without springs, as before stated, the weight of the carriage very frequently rests upon two wheels only: and in practice, therefore, we must, with these kind of carriages, suppose the whole weight acting upon two wheels.

To ensure, therefore, no increase of resistance in the use of wrought iron rails, their rigidity should be such, as that, by carriages with springs, one-fourth; and by carriages without springs, one-half of the

weight will not cause a deflection in the middle of the rail equal to ,032 *parts of an inch.*

And considering that, in the experiment, the weights were applied carefully upon the rail; and that in practice, the weight, especially in carriages without springs, will be occasionally imposed with great abruptness, it will always be adviseable, independent of making proper allowance for wear, to adopt rails of more than sufficient rigidity to resist any injurious deflection by the weight of the carriages. The tables of experiments on the rigidity of different sections of rails, will be useful in determining the proper strength for practice; both for single lengths, and with rails of several compartments in one length.

The experiments on the comparative resistance of cast and malleable iron rails, were made with the surfaces of the rails quite dry, and free from dust: to ascertain the increase of resistance by the occurrence of any extraneous matter on the rails, the surfaces were watered pretty freely. The number of vibrations, before attaining a state of rest when dry, was 540 and 570, respectively; and when watered, 375. Upon wrought iron rails, when dry, with a less extent of vibration, the number of oscillations was 404 and 412; while, when chalked, the number was 230. With cast iron, when oiled, under the same circumstances, the number was 290; and when still more copiously oiled, the number was reduced to 244.

The result of these experiments is, therefore, that no increase of resistance takes place upon wrought iron rails; and that the resistance is a minimum, when the rails are quite dry and free from any extraneous matter. [*Rep. Pat. Inv.*

On the tempering of Metallic Wires and springs for Chronometers, Watches, Musical Instruments, &c.

To the Editors of the London Journal of Arts, &c.

Gentlemen,—A course of experiments in which I have lately engaged myself, has drawn my attention to the subject of the "*spirit*," as workmen technically call it, of metallic springs. The connexion of this subject with various important branches of our arts may claim for it a small space of your valuable publication. In respect of the more important interests of navigation, as well as of numerous minor purposes, a few practical observations may prove serviceable, by extending the knowledge of the ramifications of science. Springs are made perfectly well for different objects, so far as the manufacturer is concerned,—but a more general information as to their different temper, and the principles of such difference may tend to the more correct and perfect adaptation of elastic substances to the required end of the workmen who use them.

I am indebted for much of the following information to an old French memoir, originally published in 1774, by M. Le Roy, pere, the celebrated watchmaker of Louis XV. Certain experiments in

acoustics have supplied me with proofs of his correctness, and with some generally useful memoranda.

A bar of steel or iron, after being sufficiently heated, or subjected to the action of fire, becomes successively yellow, violet, blue, gray and white. The variations in intensity of these colours will partly depend upon the state and quality of the metal operated upon. Although philosophers are agreed that all hard bodies are elastic, yet hardness does not constitute *the measure of elasticity*, for a glass ball is much more elastic than an equal globe of cast iron; but their difference of hardness is by no means proportioned to that of their elasticity. A Damascene, or Moorish sword blade, is more springy or elastic than another, which shall, notwithstanding, make an impression upon the edge of the former. Now, this difference arises from the varied mode of tempering the respective blades. The steel or iron, after each transition above noticed, is said by the French to become *revenu.*

M. Le Roy informs us that he took three wires of common steel, to which he suspended weights, and put them in pendulous motion. They did not maintain their vibrations beyond seven minutes. He then tempered them to the fourth or gray state; in this stage of *revenu* the same wires maintained the vibrations of their masses during the space of 50 minutes. A wire of cast steel, which maintained the vibrations of its suspended weight for 10 minutes, continued them after it had passed to full blue, (*gros bleu*,) an hour longer. From Dr. Thompson's published tables of Cohesion, we learn that the power, or force of cohesion of bar iron, is to that of cast iron nearly as 75 : 50; for to tear asunder rods of each species, an inch square at the base, it required 74,500 lbs. avoirdupois, to destroy the cohesion of the particles of the bar iron rod, and 50,100 lbs. to effect the breaking of the cast iron rod. The elasticity or *spirit* of tempered steel springs appears, therefore, to be in an inverse ratio to their power of cohesion. An untempered wire of a harpsichord, maintained its vibrations for 14 minutes; after being tempered to gray-white, it maintained its suspended weight in motion nearly an hour. A wire of cast steel was tempered to *gros bleu* and then was diminished, (i. e. untempered,) and polished, in which state it vibrated only 17 minutes, but upon the *revenu à gros bleu*, it vibrated 67 minutes. These general facts serve to show the great advantage of understanding the variations of tempering, as affecting the elasticity of springs, and their consequent fitness for any required purpose. Our author appears to have applied his knowledge to the formation of the best chronometer work of the period, in which art he gained a high reputation.

But mere soft metallic wires and springs without any temper, will not vibrate well, nor maintain for any great length of time a suspended pendulum bob in motion. A copper wire is unsuited for these purposes; a brass wire is suitable in proportion to the quantity of zinc in its composition, so that it does not exceed one-half; the usual proportion is four parts of copper to one of zinc. About two years after the publication, by M. Le Roy, of his experiments, Count

Bruhl, the ambassador from the court of Dresden to St. James's, and M. Phillidor, had several piano fortes made, and strung with wires tempered *gros bleu;* they were universally acknowledged by amateurs, and the Royal Academy of Paris, to be superior in tone to instruments chorded with the usual steel wire. The progress which is making in the general application of scientific principles to our various branches of manufacture, induces me to hope that these few reminiscences may prove useful to some of our artists and operatives.

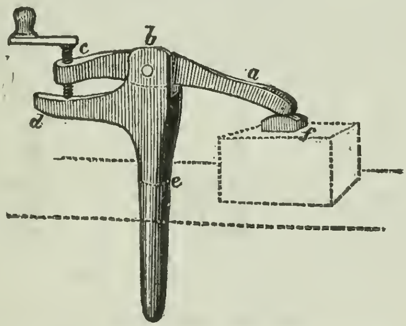
[*Lond. Jour.*

Hold-fast for Carpenters.

From the Transactions of the Society of Arts.

The common carpenter's hold-fast is a round bar of iron, thickening a little upward, and bent at the upper end almost into a right angle and flattened. An oblique hole is bored in the bench; and if a piece of wood, or any other article is wanted to be secured, it is placed under the hold-fast, and a few strokes of a mallet are sufficient to make it bite firmly. In order to loosen it, nothing more is necessary than a blow of a hammer applied at the back, or lower end of the bar.

Dungey's Hold-fast.



In Mr. Dungey's hold-fast, the jaw, *a*, instead of being one piece with the rest of the bar, is moveable on the axis *b*, and is prolonged backwards. In this latter part is a hole for the reception of a cranked screw, *c*, which bears on a projection, *d*, of the main bar: *e* is the hole in the bench, and *f* is a flat square piece fixed by a loose joint to the jaw *a*, and therefore capable of bearing by its whole surface on any piece of work placed under it. By turning the screw *c* in one direction the work is held fast, and by turning in the other direction it is released. It is considered as likely to be of service to coachmakers, carvers, and chair and cabinet makers, as the pressure of it is under perfect regulation, and it is not liable to bruise the work which it is employed to hold.

Meteorological Observations for September, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	63°	76°	29.90	29.90	62	S.	Breeze.		Clear—cloudy.
	2	68	76	.80	.80	67	S.	Calm.		Overcast—cloudy.
	3	68	77	.80	.88	67	SW. S.	Moderate.	.7	Cloudy day. Sh'r in night
	4	63	67	.86	.86	54	NE.	Breeze.		Cloudy—drizzling.
	5	63	75	.86	.86	55	W.	Moderate.		Cloudy—clear.
⊗	6	62	75	.91	.93	61	NW.	Breeze.		Clear—overcast.
	7	61	76	30.00	30.00	57	SW.	Calm.		Clear—overcast.
	8	67	76	29.90	29.87	64	SW.	Breeze.		Cloudy—overcast.
	9	67	76	.74	.74	64	NW.	Moderate.		Cloudy—overcast.
	10	69	83	.75	.75	65	SW. W.	Calm.		Fog—clear.
	11	71	82	.80	.80	64	W. SW.	Breeze.		Clear day. Shwr in night.
	12	62	72	30.00	.98	46	NW.	do.	.5	Clear day.
☽	13	56	70	.03	30.04	50	W.	Moderate.		Clear day.
	14	56	70	29.95	29.92	51	S.	do.		Cloudy day.
	15	65	70	.86	.77	61	SE.	do.	.30	Cloudy—rain.
	16	61	62	.85	.95	59	NW.	do.		Cloudy—rain.Rain night.
	17	56	63	30.00	30.02	52	N.	do.	.30	Cloudy—clear.
	18	47	63	.07	.05	40	NE.	do.		Clear day.
	19	47	69	29.98	29.95	45	NW. SW.	do.		Clear—overcast.
	20	49	73	.86	.83	50	W.	do.		Cloudy—clear.
☺	21	59	69	.83	.90	54	NE.	do.		Cloudy day.
	22	59	75	.93	.89	57	NE. SE.	Breeze.		Cl'dy—overcast. Rain n't
	23	68	69	.76	.70	67	S. NW.	Moderate.	.74	Showry—cloudy.
	24	55	68	.80	.80	45	NW. W.	do.		Clear day.
	25	55	69	.90	.86	55	NW. SW	do.		Cl'r: cld'y: rain: rain n't.
	26	63	71	.74	.74	62	NE.	do.	.62	Cloudy day.—rain night.
☾	27	61	71	.55	.55	60	NW. SW.	Breeze.	2.85	Cloudy day.
	28	51	63	.60	.70	45	W.	Blustering.		Cloudy—clear.
	29	49	64	.75	.72	49	W.	Moderate.		Clear—cloudy.
	30	44	63	.92	.94	42	NW. W.	do.		Clear day.
	Mean	59.50	71.10	29.86	29.86	56.1			4.93	

	Thermometer.	Barometer.
Maximum height during the month,	83. on 10th.	30.07 on 18th.
Minimum do. . .	44. on 30th.	29.55 on 27th.
Mean do. . .	65.80 . . .	29.86

Note to Subscribers.

Our subscribers are informed, that the delay in this number of the Journal, has been caused by the destruction of part of the printed sheets, in a fire which occurred at the printing office of the Journal.

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

NOVEMBER, 1831.

Propositions and Suggestions on the means of obviating or lessening the accidents incident to Navigation by Steam. By John S. Williams, *Engineer.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—I have with much satisfaction read the remarks of Mr. Earle, (vol. vii. p. 154,) on the causes of some explosions in steam boilers. I fully believe the reasons he assigns, and the conclusions he arrives at, to be correct. Apprehending, however, that he has been too brief respecting preventives, I shall add a few paragraphs upon this subject; in doing which I shall not confine myself to any one particular class of accidents to which navigation by steam is liable.

Upon the western waters, steam boats have, at an average, from 4 to 5 boilers each, of 36 inches in diameter, and 18 feet long, with two flues of 13 inches in diameter, running from end to end of each boiler. These boilers are placed upon a horizontal bed occupying a breadth of from 12 to 15 feet across the fore part of the boat.

A very large proportion of the explosions of boilers, say five-sixths, are occasioned by the collapsing of the flues, and not, as is commonly reported, by the bursting of the boiler proper. The reason of this appears to be that metal of the strength to resist a rent is by no means adequate to prevent a collapse. The ability of flues to sustain the pressure of the steam, is the mere stiffness of the metal in conjunction with the perfect regularity with which the arch or circular shape of the flue is constructed and maintained. Should one diameter of a flue exceed another only by one inch, when the steam

is up to 100 pounds upon the square inch, there would, in a flue 18 feet long, be 21,600 pounds of force applied directly to produce a collapse. There is little danger attending the collapse of a good flue, save from the rending of the metal from the head of the boiler, which is very apt to take place. Flues, however, have collapsed without leaking a drop, and consequently without further damage than the loss of the flue itself; this has happened when the boiler heads have been made of wrought iron, but perhaps never with cast heads, which ought to be rejected. Cast heads are apt to crack by frequent heatings, and when they give way, they deal destruction fore and aft.

I agree with Mr. Earle in the idea that it injures boilers and flues to be overheated, even if they should not explode at the time. I am fully persuaded that metal overheated under a high pressure is never again so fit to bear pressure either as a boiler or flue. Perhaps the reason may be that, to lower the temperature of iron a little, and suddenly, under a high pressure, operates upon the structure of the metal the same as to cool it to a greater degree under a less pressure. Not only ought the overheating of boilers and flues to be guarded against with all possible care on this account, but because the overheating is very likely to generate a quantity of highly rarified steam, to the destruction of boiler, boat, and crew, by a sudden explosion. The most common causes of the overheating of boilers and flues are, undoubtedly, carelessness, or want of skill, in the engineer, who may let the water get too low; an unnoticed failure of the force pump to perform its duty; the rolling of the boat in a heavy sea; or any thing else that causes the boat to tilt, such as the running of passengers to the side next to an approximate town or shore, combined with the discharge and reception of freight, and the reception of wood at the same side. This occasions the water to flow through the connexions from the higher boilers to the lower, and this again increases the bias, and draws more water after it. The best height of water for generating steam, is when the flues are kept just covered by it, and no more. Hence some engineers run the water very close, not allowing it to rise more than one or two inches over the flues. It is then plain that a small tilt or bias in the boat will lay the flues in one, or more, of the boilers, instantly bare, which soon becomes much heated, and generates a quantity of highly elastic steam upon the boat being restored to its level, so as to cause the water to take its proper position. In this situation, should the heated flue have the least irregular shape, so as to *favour* such a circumstance, it will collapse vertically, because the heated part of the flue is robbed, by the heat, of its stiffness, which is its only means of supporting its burthen. But should a flue thus partially heated, have been constructed perfectly cylindrical, I presume the collapse will then be horizontal, inasmuch as heating the upper part necessarily lengthens the horizontal diameter. Unless the boilers be uncommonly strong, the steam thus suddenly generated, must get vent either by valves or by an explosion; in many instances, by collapse only, but most destructively by bursting.

I now proceed to give some ideas as to the most likely means of

preventing such occurrences. In order to prevent the danger attending the tilting or sidelong position into which boats will necessarily be thrown at times, it is suggested that the boilers be unconnected, and that each be supplied by a force pump separately. But should this be thought troublesome and expensive, let the pipe from the force pump have a branch running to each boiler separately; let each of these boilers be furnished with a valve and stop cock, the valve opening towards the boiler; and let the steam pipes also, which lead out of each boiler, be furnished with a valve opening towards the cylinder. It is evident that in a boat where the boilers were thus connected, or rather, thus disconnected, no water could flow from the higher towards the lower boilers, were the boat tilted ever so much. In this case, the flues would be relieved of much of their present exposure to heat, because the water in each boiler must waste by evaporation, not flow out, before its flues would be laid bare. Thus, even were no water pumped in, twenty minutes or half an hour might be spent in this situation, without exposing the flues, under the calculation that the perpendicular waste of water is about an inch in ten minutes while running. Further; boilers thus situated would be less dangerous, not only because the flues and sides would be less exposed to heat, but because, even supposing them heated, they would not be subjected to a sudden reflux of water from the other boilers upon the boat being restored to her proper trim. It is conceded that should the force pumps play while the boat is out of trim the water would be thrown into the lower boilers, and after the trim should be restored, into the others, until all would be on a level; but the introduction of stop cocks into the pipes furnishes the means of regulating the supply of water in any position. By making a hole in one side of these pipes, and introducing three-way-cocks, means are also obtained of drawing off the water from any one, or all, of the boilers, separately, if the supply pipes are lower than the boilers.

In the steam pipe of each boiler, by which it is connected to the common steam pipe, a valve should be placed, opening upwards. Each boiler would thus give its supply of steam independently of the others, and if from any accident steam ceased to be generated in one, its valve would be closed by the pressure of steam from the other boilers, and all waste be thus prevented.

The valves above mentioned to be placed in the steam pipes would, by no means, obstruct the passage of the steam from the boilers to the cylinder, neither would they prevent the perfect equilibrium of the steam to the creation of any danger. The steam in each boiler would maintain the same pressure as the steam in the common pipe or cylinder, or be below that pressure. Let the safety valve be placed on the common pipe where the steam from all the boilers unites. In this case any one boiler, which might be suddenly surcharged with steam would open and occupy the whole capacity of the safety valve for its own relief, which would thus be more effectual. Again; under this disposition of boilers, a surcharge in one would not occasion the collapse of a weak or misshapen flue in another, nor another boiler, that might be deficient, to burst. On a boat with five boilers and ten

flues, connected in the common way, the chances are against the bursting or collapsing taking place in the same boiler in which the cause of the accident occurs; but under this arrangement, both must take place in one, or the accident will not happen, by reason of the surcharged boiler being sufficient to bear the pressure. It seems to me that this would greatly lessen the number of accidents. Under the present arrangement, when one flue or boiler gives way, all the power of every boiler is exerted through the connexions, and acts upon the deficient one to render the destruction complete; but under the arrangement here proposed, the power of one boiler only would be exerted upon the boat, its contents, and crew. This is certainly an important consideration, which would hold good in all cases of collapse, and seldom fail in cases of bursting, were the boilers properly secured in their places. But further, there would another advantage attend this proposed arrangement, which, though mentioned last, may be equally worthy of consideration with the preceding. It is this—that in case of an accident, by collapse or by bursting, if the whole bed should not be deranged, not a stroke of the piston would be lost. The remainder of the boilers would not cease to drive the engine, although with diminished power. The vessel would still be under the command of the pilot, and enable him to pursue his voyage or to run into port, where medical aid and other comforts, might be obtained for the wounded. This circumstance alone would take off much of the appalling aspect of such occurrences. For part of a crew to be killed, and others crippled, and, withal, for the boat under these, the most distressing, circumstances, to be completely deprived of power, is such a picture as I can hardly bear to contemplate when I draw it; neither would it be drawn did I not believe myself to be urging measures to lessen the frequency of its occurrence as well as the horror of its features. It is true that after such an accident has occurred to one of the boilers, and, of course, all the pressure in it taken off, all the water from the force pump would be thrown into this deficient boiler. But in the course of 15 or 20 minutes, before any danger from running without a supply would occur, the engineer or some one, might turn the stop cock leading into that boiler, and force the supply into the others, when every thing would go on as before the accident, with the loss of only so much power as had been obtained from the injured boiler.

While on the subject of lessening the force of such accidents, in the destruction occasioned by them, permit me to recommend what has been repeatedly urged by others, that an almost impregnable partition be constructed to defend the lives of those passengers who shall keep their proper places. A strong bulk-head placed aft of the flues, would dissipate the force of the steam in the fire bed and through the sound flues, if the discharge was backward, as the contents of one only would have to be guarded against; and chimneys well secured, and of nearly equal strength with the boilers, would be likely to turn all the contents of one boiler upward. In this way the life of many a fireman, as well as those of passengers, would be saved.

As explosions by bursting are the more destructive, so those by collapses are the more frequent; thus by them, many lives and much property are lost. Every precaution that ingenuity can devise, or discretion suggest, ought to be adopted to prevent their occurrence, and lessen their destructive effects when they do occur. Let, then, the strength of metal be increased, or the diameters of both boilers and flues be diminished, and their numbers increased, to accomplish the same ends. Although our means of precaution may be expensive or troublesome, (which is not admitted to be the fact,) yet the increased confidence and business of that mode of conveyance, would amply repay the prudent, as well for a small expense, as for the additional care in keeping their boilers clear of earthy and saline matter, which tends greatly to their decay, if not to their sudden and total destruction.

After having suggested several improvements in supplying boilers with the common pump, allow me to take a brief notice of a patent obtained by me, for what I believe to be an improved method of supplying the boilers of steam engines with water. I mention it with hesitancy, although I have much confidence in its utility, but am not now so situated as to put it into operation myself; should any one, however, conceive it worth an experiment, and apply to me, post paid, for a right to use it, I hope to convince him that a sordid love of gain forms no part of my composition. This invention was published by you, with a cut, in March last, vol. vii. p. 183. A common boiler would require the water chamber, B, [see the cut,] to be from 6 to 9 inches cubic; and the reservoir might be nothing more than a pipe or apartment kept supplied by a fount from the condenser, the hot well, or the cold water pump. The whole structure might be attached to the main head, and with it removed, cleaned, inspected, or repaired, with the greatest ease and convenience. The cut shows the principle in the easiest way it could be presented to the eye, but not the most convenient mode of applying it to the machinery. Instead of the cocks, E and F, a sliding escapement, a four-way-cock, or a double conic valve, will be easy to construct, and readily connected with the motion of the engine. A wooden float in the chamber B, would prevent condensation by separating the steam from the water. The apparatus can be attached to any part of, and all sorts of boilers, or connected with them by pipes, provided the necessary levels are preserved.

I propose that one apparatus should be attached to each boiler in boats, with valves in the steam pipes, as above recommended. To the advantages gained by the above arrangement, with the common force pump, I presume the following will be added; my apparatus will require no stuffing, and have fewer wearing parts; it would introduce no greasy and linty substances into the boilers, which, combining with earthy matter, sometimes form blackberries, (so called,) which burn to the bottom; it requires less power to keep it going, and by a small discharge of steam at every operation, would notify its proper action; it will keep the water in the boilers always at the same height, by discharging more than the waste when the water

is too low, and less when it is too high in the boiler, if accident or design should make it so. Thus by its own operations, would it find the proper height for the water, and steadily maintain it at that height as long as the operation goes on, and the supply kept up. And, lastly, should the boat lie ever so sidelong, it would keep in every boiler its proper supply of water.

But, after all, accidents will occur, under the management of unskilful and careless engineers; boat owners are frequently imposed upon by vagrants under that name. The remarks of your correspondent, R. D. H. published in vol. vii. p. 289, are, in the main, very judicious, and I hope he will succeed in his experiments. Safety valves are certainly a security, if properly constructed, and left to operate freely; but they are often tied down, and are thus rendered useless. I lately passed a boat in which I know that the engineer had been in the constant practice of tying his safety valve down under the power of a double lever. I passed by it in another boat, and, as might be expected, death and destruction had visited the spot. I could enlarge, but charity throws a veil over the past, and seeks a future remedy. Let those who are competent devise it, and those who have power and means carry it into effect. Let there be a Board of Inquiry to examine the moral standing and skill of engineers and pilots; let boilers be tested, let large safety valves be placed out of the reach of all on board, let the causes of accidents be inquired into, or let any method, in any way promising, be adopted and pursued that might tend to lessen the evil, and increase the chances of escape.

Another class of accidents to which steam boats are liable is that of fire. Is it not almost incredible that a vessel whose very propelling power arises from fire, and in which a profuse application is made of oil, which is built of the most light and combustible materials, exposed to numberless sparks, and the constant heat of a furnace, should be seldom or never guarded against consumption by fire? Would not a force pump, worked by the engine, supplied with hose, be a necessary appendage to them?

Boats running into and sinking each other, and boats burned to the water's edge in a few minutes, boilers bursting, and flues collapsing, together with the attendant death and destruction, make up a considerable amount of human ills, which call loudly upon the powerful and the humane for their exertions to arrest. Power by steam, managed as it might be, would not only be the easiest and cheapest mode of transit for goods and passengers, but the safest also; but for the want of skill or attention, our use of it has increased greatly beyond our provisions for rendering it so.

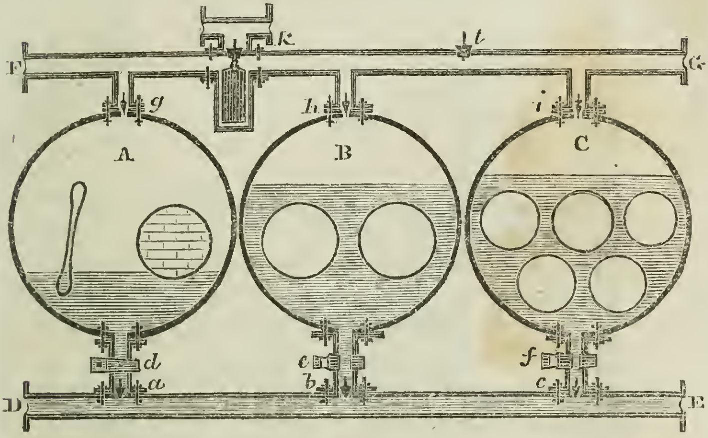
Being deeply impressed with the importance of my subject, it has been extended to a greater length than I had anticipated; if I have been tedious, let the motive plead my excuse with your readers.

Yours respectfully,

Jno. S. Williams.

Washington, Mason county, Ky. Sept. 12, 1831.

Notes and references explanatory of the accompanying drawing, and Illustrative of the mode of connecting boilers recommended in the foregoing essay.



A B C, sections of three boilers placed at or near a level.

D E, supply pipes. *a b c*, valves opening from the supply pipe towards the boilers. *d e f*, stop cocks between said valves and the boilers, which by being made three-way-cocks, may serve to drain the boilers.

F G, steam pipes leading from the boilers to the cylinder. *g h i*, valves opening from the boilers towards the cylinder. *k l*, safety valves, one of which might be encased with its burthen, even inside of the boiler or pipe, as at *k*.

Boiler A has one flue collapsed and the other walled up to prevent a draft. The deficient boiler may have as much water kept in it as it will hold, to prevent burning. Meanwhile boilers B and C have not ceased for a moment to supply steam, and, consequently, power, to the cylinder.

Boiler C is placed in a manner that is believed would not be subject to collapses, and at the same time generate much more steam than the common method in proportion to the weight of the boiler and water.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a Moving Power.

(Continued from p. 221.)

Table I.—Part I.

Chute No. 4.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	12.54	14.47	15.72	0.50	566	50.00	616.00	41.5	38	10.28	2850	23.00	655500	255640	.389			
2					669	51.81	720.81		44	8.88	3275		753250	299136	.397	.397	8.88	
3					772	53.62	825.62		50	7.82	3800		874000	342632	.392			
4					875	55.43	930.43		59	6.62	4400		1012000	386128	.381			
5					978	57.24	1035.24		69	5.66	5110		1175300	429624	.365			
6					1081	59.05	1140.05		79	4.95	5825		1339750	473120	.353			
7	12.54	14.47	15.72	0.75	566	50.00	616.00	41.5	26	15.03	3050	23.00	701500	255640	.364			
8					669	51.81	720.81		27	14.48	3400		782000	299136	.382			
9					772	53.62	825.62		30	13.02	3650		839500	342632	.408			
10					875	55.43	930.43		34	11.50	3970		913100	386128	.422			
11					978	57.24	1035.24		37	10.56	4350		1000500	429624	.429	.429	10.56	
12					1081	59.05	1140.05		41	9.54	4825		1109750	473120	.426			
13					1184	60.86	1244.86		44	8.88	5275		1213250	516617	.425			
14					1287	65.23	1352.23		49	7.98	5875		1351250	561175	.417			
15					1390	69.60	1459.60		55	7.10	6500		1495000	605734	.415			
16					1493	73.97	1566.97		60	6.50	7250		1667500	650293	.390			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE I.—PART II.

CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
17	10.29	12.22	13.47	0.75	669	51.81	720.81	41.5	32	12.20	3475	20.75	721062	299136	.414			
18					772	53.62	825.62		33	11.84	3800		788500	342632	.434			
19					875	55.43	930.43		38	10.28	4175		866312	386128	.445			
20					978	57.24	1035.24		41	9.53	4600		954500	429624	.450	.450	9.53	
21					1081	59.05	1140.05		46	8.50	5125		1063437	473120	.445			
22					1184	60.86	1244.86		51	7.66	5700		1182750	516617	.435			
23					1287	65.23	1352.23		57	6.86	6300		1307250	561175	.428			
24					1390	69.60	1459.60		64	6.10	7050		1462875	605734	.414			
25	10.29	12.22	13.47	1.00	875	55.43	930.43	41.5	29	13.48	4425	20.75	918187	386128	.420			
26					1081	59.05	1140.05		35	11.16	5050		1047875	473120	.451	.451	11.16	
27					1184	60.86	1244.86		38	10.28	5585		1158887	516617	.445			
28					1287	65.23	1352.23		40	9.77	6100		1265850	561175	.443			
29					1390	69.60	1459.60		45	8.71	6675		1385062	605734	.437			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE I.—PART III.

CHUTE No. 4.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wtofwater expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
30	7.29	9.22	10.47	0.75	566	50.00	616.00	41.5	33	11.84	3300	17.75	585750	255640	.436			
31					669	51.81	720.81		38	10.28	3625		643437	299136	.465			
32					772	53.62	825.62		41	9.54	4075		723312	342632	.473			
33					875	55.43	930.43		47	8.32	4550		807625	386128	.478	.478	8.32	
34					978	57.24	1035.24		53	7.38	5125		909687	429624	.472			
35					1081	59.05	1140.05		58	6.74	5700		1011750	473120	.467			
36					1184	60.86	1244.86		65	6.00	6375		1131562	516617	.456			
37					1287	65.23	1352.23		73	5.35	7125		1264687	561175	.443			
38	7.29	9.22	10.47	1.00	978	57.24	1035.24	41.5	39	10.02	4925	17.75	874187	429624	.491			
39					1081	59.05	1140.05		43	9.09	5400		958500	473120	.493	.493	9.09	
40					1184	60.86	1244.86		46	8.50	6000		1065000	516617	.485			
41					1287	65.23	1352.23		52	7.52	6575		1167062	561175	.480			
42					1390	69.60	1459.60		58	6.74	7225		1282437	605734	.473			
43					1493	73.97	1566.97		63	6.20	7850		1393375	650293	.466			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table I.—Part IV.

Chute No. 4.—*Elbow buckets. Close breast. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
44	4.29	6.22	7.47	0.75	463	48.19	511.19	41.5	38	10.28	3010	14.75	443975	212144	.477			Experiments were made on a head of 11.75 feet, but the back of the chute was too high to permit a flow sufficient to fill the aperture; in consequence of this, the ratios did not increase in a due proportion to the diminution of the head. It has not been deemed necessary to record those experiments in the tables.
45					566	50.00	616.00		45	8.71	3475		512562	255640	.498			
46					669	51.81	720.81		50	7.82	3975		586312	299136	.510			
47					772	53.62	825.62		57	6.86	4525		667437	342632	.513	.513	6.86	
48					875	55.43	930.43		66	5.92	5150		759625	386128	.508			
49					978	57.24	1035.24		75	5.21	5875		866562	429624	.495			
50					1081	59.05	1140.05		85	4.60	6650		980875	473120	.482			
51	4.29	6.22	7.47	1.00	772	53.62	825.62	41.5	43	9.09	4350	14.75	641625	342632	.534			
52					875	55.43	930.43		48	8.14	4860		716850	386128	.538	.538	8.14	
53					978	57.24	1035.24		55	7.10	5450		803870	429624	.534			
54					1081	59.05	1140.05		59	6.62	6075		896062	473120	.528			
55	4.29	6.22	7.47	1.25	875	55.43	930.43	41.5	40	9.77	4850	14.75	718370	386128	.537			
56					978	57.24	1035.24		44	8.88	5350		789120	429624	.544	.544	8.88	
57					1081	59.05	1140.05		49	7.98	5925		873937	473120	.541			
58					1184	60.86	1244.86		54	7.24	6575		969812	516617	.532			
59					1287	65.23	1352.23		61	6.40	7225		1065687	561175	.526			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—PART I.

CHUTE NO. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being I.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	12.54	14.47	15.72	0.50	360	46.38	406.38	41.5	38	10.28	2210	23.00	508300	168647	.331			
2					463	48.19	511.19		47	8.32	2650		609500	212144	.348			
3					566	50.00	616.00		55	7.10	3135		721050	255640	.354	.354	7.10	
4					669	51.81	720.81		66	5.92	3710		853300	299136	.350			
5	12.54	14.47	15.72	0.75	669	51.81	720.81	41.5	33	11.84	3420	23.00	786600	299136	.380			
6					772	53.62	825.62		38	10.28	3800		874000	342632	.393			
7					875	55.43	930.43		40	9.77	4155		955650	386128	.404			
8					978	57.24	1035.24		43	9.09	4560		1048800	429624	.409	.409	9.09	
9					1081	59.05	1140.05		46	8.50	5050		1161500	473120	.407			
10					1184	60.86	1244.86		48	8.14	5525		1270750	516617	.406			
11					1287	65.23	1352.23		53	7.38	6125		1408750	561175	.398			
12	12.54	14.47	15.72	1.00	772	53.62	825.62	41.5	29	13.48	3910	23.00	893730	342632	.383			
13					875	55.43	930.43		32	12.20	4160		956800	386128	.403			
14					978	57.24	1035.24		36	10.86	4560		1048800	429624	.409			
15					1081	59.05	1140.05		39	10.02	4990		1147700	473120	.412			
16					1184	60.86	1244.86		40	9.77	5375		1236250	516617	.418	.418	9.77	
17					1287	65.23	1352.23		43	9.09	5850		1345500	561175	.417			
18					1390	69.60	1459.60		46	8.50	6375		1466250	605734	.413			
19					1493	73.97	1566.97		53	7.38	7105		1634150	650293	.398			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—PART II.

CHUTE NO. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Btm. of Bkt.	Top of Bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
20	10.29	12.22	13.47	0.50	360	46.38	406.38	41.5	39	10.02	2370	20.75	491775	168647	.343			
21					463	48.19	511.19		47	8.32	2830		587225	212144	.361			
22					566	50.00	616.00		50	7.82	3250		674375	255640	.379	.379	7.82	
23					669	51.81	720.81		67	5.84	3950		819625	299136	.364			
24	10.29	12.22	13.47	0.75	669	51.81	720.81	41.5	35	11.16	3635	20.75	754262	299136	.396			
25					772	53.62	825.62		39	10.02	4000		830000	342632	.413			
26					875	55.43	930.43		41	9.54	4430		919225	386128	.420			
27					978	57.24	1035.24		47	8.32	4910		1018825	429624	.421	.421	8.32	
28					1081	59.05	1140.05		54	7.24	5470		1135025	473120	.416			
29					1184	60.86	1244.86		59	6.62	6065		1258487	516617	.410			
30	10.29	12.22	13.47	1.00	978	57.24	1035.24	41.5	38	10.28	4780	20.75	991850	429624	.433			
31					1081	59.05	1140.05		40	9.77	5200		1079000	473120	.438			
32					1184	60.86	1244.86		44	8.88	5645		1171337	516617	.441	.441	8.88	
33					1287	65.23	1352.23		48	8.14	6275		1302062	561175	.431			
34					1390	69.60	1459.60		54	7.24	6900		1431750	605734	.423			
35	10.29	12.22	13.47	1.25	1081	59.05	1140.05	41.5	32	12.20	5150	20.75	1068625	473120	.442			
36					1184	60.86	1244.86		35	11.16	5580		1157850	516617	.446			
37					1287	65.23	1352.23		37	10.56	5880		1220100	561175	.460	.460	10.56	
38					1390	69.60	1459.60		41	9.54	6450		1338375	605734	.452			
39					1493	73.97	1566.97		44	8.88	7000		1452500	650293	.447			
1	2	4	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table K.—Part III.

Chute No. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
40	7.29	9.22	10.47	0.50	257	44.57	301.57	41.5	37	10.56	2050	17.75	363875	125152	.344			
41					360	46.38	406.38		45	8.70	2520		447300	168647	.377			
42					463	48.19	511.19		53	7.38	3010		534275	212144	.397			
43					566	50.00	616.00		64	6.10	3575		634562	255640	.403			
44					669	51.81	720.81		73	5.35	4160		738400	299136	.405	.405	5.35	
45					772	53.62	825.62		86	4.54	4875		865312	342632	.396			
46					875	55.43	930.43		105	3.72	5700		1011750	386128	.381			
47	7.29	9.22	10.47	0.75	669	51.81	720.81	41.5	42	9.31	3835	17.75	680712	299136	.439			
48					772	53.62	825.62		46	8.50	4240		752600	342632	.455	.455	8.50	
49					875	55.43	930.43		52	7.52	4790		850225	386128	.454			
50					978	57.24	1035.24		58	6.74	5350		949625	429624	.452			
51	7.29	9.22	10.47	1.00	875	55.43	930.43	41.5	42	9.31	4675	17.75	829812	386128	.465			
52					978	57.24	1035.24		46	8.50	5110		907250	429624	.473	.473	8.50	
53					1081	59.05	1140.05		50	7.82	5650		1002875	473120	.471			
54					1184	60.86	1244.86		54	7.24	6225		1104937	516617	.467			
55					1287	65.23	1352.23		62	6.30	6935		1230962	560175	.455			
56	7.29	9.22	10.47	1.25	978	57.24	1035.24	41.5	37	10.56	5120	17.75	908800	429624	.472			
57					1081	59.05	1140.05		39	10.02	5500		976250	473120	.484			
58					1184	60.86	1244.86		44	8.88	6000		1065000	516617	.485	.485	8.88	
59					1287	65.23	1352.23		47	8.32	6530		1159075	560175	.483			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—PART IV:

CHUTE No. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
60	7.29	9.22	10.47	1.50	1081	59.05	1140.05	41.5	34	11.50	5550	17.75	985125	473120	.480			
61					1184	60.86	1244.86		38	10.28	5950		1056125	516617	.489			
62					1287	65.23	1352.23		40	9.77	6400		1136000	561175	.494			
63					1390	69.60	1459.60		43	9.09	6850		1215875	605734	.498	.498	9.09	
64					1493	73.97	1566.97		46	8.50	7500		1331250	650293	.488			
65					1596	78.34	1674.34		50	7.82	8110		1439525	694851	.482			
66	4.29	6.22	7.47	0.75	463	48.19	511.19	41.5	47	8.32	3175	14.75	468312	212144	.453			
67					566	50.00	616.00		57	6.86	3725		549437	255640	.465			
68					669	51.81	720.81		66	5.92	4270		629825	299136	.474	.474	5.92	
69					772	53.62	825.62		76	5.14	4975		733812	342632	.466			
70	4.29	6.22	7.47	1.00	566	50.00	616.00	41.5	40	9.77	3700	14.75	545750	255640	.468			
71					669	51.81	720.81		46	8.50	4150		612125	299136	.488			
72					772	53.62	825.62		52	7.52	4635		683662	342632	.500			
73					875	55.43	930.43		58	6.74	5160		761100	386128	.507	.507	6.74	
74					978	57.24	1035.24		64	6.10	5750		848125	429624	.506			
75					1081	59.05	1140.05		71	5.50	6410		945475	473120	.500			
76	4.29	9.22	7.47	1.25	875	55.43	940.43	41.5	46	8.50	5000	14.75	737500	386128	.523			
77					978	57.24	1035.24		50	7.82	5500		811250	429624	.529	.529	7.82	
78					1081	59.05	1140.05		56	6.98	6100		899750	473120	.525			
79					1184	60.86	1244.86		61	6.40	6700		988250	516617	.522			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—PART V.

CHUTE NO. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Seds.	Feet.	Pds.	Feet.						
80	4.29	6.22	7.47	1.50	978	57.24	135.24	41.5	43	9.09	5470	14.75	806825	429624	.532			
81					1081	59.05	1140.05		46	8.50	5875		866562	473120	.546	.546	8.50	
82					1184	60.86	1244.86		51	7.66	6525		962437	516617	.536			
83					1287	65.23	1352.23		56	6.98	7135		1052412	561175	.533			
84	4.29	6.22	7.47	1.75	1081	59.05	1140.05	41.5	35	11.16	6325	14.75	932937	473120	.507			
85					1184	60.86	1244.86		37	10.56	6765		997837	516617	.517			
86					1287	65.23	1352.23		39	10.02	7125		1050931	561175	.534			
87					1390	69.60	1459.60		43	9.09	7625		1124687	605734	.538			
88					1493	73.97	1566.97		44	8.88	8050		1187375	650293	.547	.547	8.88	
89					1596	78.34	1674.34		56	6.98	8875		1309062	694851	.530			
90	1.54	3.47	4.72	1.00	257	44.57	301.57	41.5	41	9.54	2350	12.00	282000	125152	.443			
91					463	48.19	511.19		60	6.50	3400		408000	212144	.520			
92					566	50.00	616.00		70	5.58	4010		481200	255640	.531			
93					669	51.81	720.81		82	4.77	4650		558000	299136	.536	.536	4.77	
94					772	53.62	825.62		95	4.11	5400		648000	342632	.528			
95					875	55.43	930.43		110	3.55	6225		747000	386128	.517			
96	1.54	3.47	4.72	1.25	566	50.00	616.00	41.5	57	6.86	3910	12.00	469200	255640	.544			
97					669	51.81	720.81		67	5.84	4475		537000	299136	.556			
98					772	53.62	825.62		74	5.28	5100		612000	342632	.559	.559	5.28	
99					875	55.43	930.43		86	4.54	5935		712200	386128	.542			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE K.—Part VI.

CHUTE No. 4.—*Centre buckets. Bottom of gate* 10.46 *feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pds.	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
100	1.54	3.47	4.72	1.50	566	50.00	616.00	41.5	49	7.98	3885	12.00	466200	255640	.548			
101					669	51.81	720.81		59	6.62	4475		537000	299136	.557			
102					772	53.62	825.62		66	5.92	5050		606000	342632	.565			
103					875	55.43	930.43		73	5.35	5680		681600	386128	.566	.566	5.35	
104					978	57.24	1035.24		82	4.77	6465		775800	429624	.553			
105					1081	59.05	1140.05		93	4.20	7320		878400	473120	.538			
106	1.54	3.47	4.72	1.75	669	51.81	720.81	41.5	49	7.98	4450	12.00	534000	299136	.560			
107					772	53.62	825.62		55	7.10	4975		597000	342632	.574			
108					875	55.43	930.43		62	6.30	5575		669000	386128	.577			
109					978	57.24	1035.24		68	5.75	6150		738000	429624	.582	.582	5.75	
110					1081	59.05	1140.05		79	4.95	7025		843000	473120	.561			
111	1.54	3.47	4.72	2.00	978	57.24	1035.24	41.5	58	6.73	6075	12.00	729000	429624	.589			
112					1081	59.05	1140.05		62	6.30	6675		801000	473120	.590	.590	6.30	
113					1184	60.86	1244.86		72	5.43	7375		885000	516617	.583			
114	1.29	3.22	4.47	1.00	463	48.19	511.19	41.5	70	5.58	3545	11.75	416537	212144	.509			
115					566	50.00	616.00		82	4.77	4150		487625	255640	.524	.524	4.77	
116					669	51.81	720.81		96	4.07	4890		574575	299136	.521			
117	1.29	3.22	4.47	1.50	566	50.00	616.00	41.5	72	5.43	4075	11.75	478812	255640	.533			
118					669	51.81	720.81		78	5.01	4700		552250	299136	.542	.542	5.01	
119					772	53.62	825.62		94	4.16	5500		646250	342632	.530			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

[Continued from p. 247.]

(No. III.)

Letter from General Swift to one of the Committee on Explosions, dated

Geneva, New York, July 15, 1830.

Dear Sir,—During my absence on Lake Ontario, your letter of the 6th instant, relative to the explosion of the boilers of the Helen M'Gregor, was received. I know very little about it, as you will perceive. In March last, I overtook the steam boat on the Mississippi, and made very particular inquiry of the passengers, in order to compare it with the accounts of former days of the explosions of the Ætna, and of the Hoboken ferry boat, at New York, &c.

From the inquiries it became soon apparent that a very common ignorance prevailed; for passengers rarely make any useful examination of steam machinery: very few of them knew any thing of the structure of the machine, or of the mode by which the steam is retained, or applied to motion.

Some of the passengers said that the boat, as it lay adjacent to the river bank, was so "keeled over" that one of the wing boilers could not have had any water in it, and that in that position it was when it burst or collapsed. Others said that the steam was not "let off," because the engineer was expecting that all persons would be on board in a moment or two, and thus the pressure of steam became too great and burst two of the boilers, endwise and upward. Others said that one boiler had burst, and another shrunk or collapsed. One of the passengers, who appeared to have a clear recollection, said that two of the boiler-heads, (for there were several contiguous boilers, as is usual,) burst towards the cabin, and came in contact with two iron stanchions, and were by them reflected, (direction changed,) and went through the sides of the bulk heads. All agreed that one boiler was thrown about forty feet from the boat, and struck in the bank with one end uppermost, and the head of the boiler of that end blown out. The iron stanchions, probably, saved many of the cabin passengers, who were at breakfast, from wounds and death. The passengers generally agreed that the boilers were weak: how they came to this, or any other, knowledge about them I know not. *The boat was an old boat.* When I went on board the Helen M'Gregor it was night; "the wreck cleared away;" the hull of the boat apparently little injured. I concluded that part had burst and part had collapsed, and that all the bursting had been upwards and sidewise, and endwise. The published account of a passenger contains as much as any one of them knew, or as any one on board knew, save the principal engineer, who, if a competent person, knew best the actual state of the boilers and machinery.

I am of opinion that carelessness and ignorance, combined, have been the chief causes of the bursting of boilers. No doubt many have

been burst by using or wearing the boiler for too great a length of time; moreover, I do not believe that the state of the boiler is sufficiently often inspected, from its being a tedious operation and requiring a well informed person to make the survey. I have observed many engineers whose care and attention were exemplary, I have also seen those who did not pay the requisite attention to determine the relative state and position of the water and the steam, while fire was under the boilers. I consider low pressure steam boats more safe than high pressure, only because the former may admit of greater carelessness with impunity, than the latter. Much of the safety and strength of boilers depending on the quality of the iron, (used on fresh water,) it is very desirable to determine its durability or toughness by some legal inspection and seal; and whether brittle when hot or cold; and to know whether the plates in any one boiler have equal strength in those particulars before being put together.* The effect of high temperature upon the strength of iron plates, with reference to finding means to resist the effects of the sudden contact of steam, atmospheric air, &c. &c. should be experimented upon.

After all the precautions which theory and experience have suggested, there is one quality in men which will ever make a steam boiler a dangerous companion in travelling—I mean temerity. All know that without careful attention the strongest boiler may be burst, and that heedlessness is one of the common consequences of habitual association with dangerous machinery. From these and other considerations I am satisfied that there is no known safety for passengers conveyed by steam, equal to tow boats or safety barges; the loss in velocity is more than compensated by quiet and safety. Wishing you success in your laudable and scientific efforts for the public good, I remain

Your respectful friend,
J. Swift.

(No. IV.)

Dumfries, Virginia, August 20, 1830.

Sir,—A passenger of the steam boat Helen M'Gregor feels authorized to reply to the circular of the Franklin Institute, and briefly responds to the first inquiry; that boilers are often burst by the confidence engineers have in their strength, frequently by neglecting to let off the steam, and sometimes by cracks and flaws in the boiler heads. In the case of the Helen M'Gregor, the boiler-head of the one that exploded was cracked, and the engineer neglected to let off the steam in time: he had his hand on the wrench of the screw to let the steam into the cylinder at the time of the explosion.

Inquiry 2nd. The best means to obviate the frequency of explo-

* The necessity for which is suggested by the effect produced upon the boiler of the Ætna.

sions, is to pass a law requiring boiler-iron to be one inch thick; and in high pressure engines that not more than seventy-five pounds of steam shall be carried to the inch; the boats would go slower, but their safety would be beyond question. Boiler-heads to be of wrought iron.

Inquiry 3d. The means to apply those remedies.—Let the Inspector of the customs at each port be directed to examine the thickness of the boiler-iron, to see that the heads are of wrought iron, and that the boilers are carefully rivetted, screwed, and hooped; and that for carrying more than seventy-five pounds of steam to the square inch, on conviction thereof, a fine of 1000 dollars shall be imposed; one-half to the informer, the other half to government, to cover expenses of prosecution, &c.

The boilers of the Helen M'Gregor, six in number, were about four feet in diameter, eighteen feet long, of wrought iron, one-fourth inch thick, with cast iron heads. The head that blew out broke into numerous small fragments, killed several persons, and wounded others.

Boilers should be of cylinder form, long enough to reach across the boat; the diameter about one-fifth of its length; American iron is safer, and less brittle than Swedish or Russian, and I think than English also.

Arrangement in the boat.—Across, so as to have the fire place on the guards, which should, at that point, project into a platform of the form of a segment. In this position, if the boiler heads blew out no danger would be apprehended to those in the bow or stern, above or below. At least nine times out of ten, boilers have blown their heads off, leaving the sides perfectly free from even a crack or flaw. When several boilers are ranged alongside each other, they have a connexion pipe, which terminates in a larger one, conveying the steam to the flues and cylinders. On this large pipe is fixed the safety valve, its form is simple, and may be understood by a schoolboy.

Large boilers may be placed with safety on the guards, one on each, which would be quite as efficient, except at sea.

If this meets with approbation it will gratify the writer, whose name may be known of the postmaster at Dumfries.

W. S. C.

(No. V.)

Extract of a letter from Wm. Littlefield, Esq. of Newport, R. I., dated
Columbia, December 2, 1830.

My Dear Sir,—In conformity with your wishes, expressed at our last meeting, I took some pains while descending the Ohio, to inquire at every place where we stopped, and from every person I thought qualified to afford information, respecting the explosion on board the steam boat Caledonia. I will now give you all I could learn on the subject, though by no means sure that I can throw any new light upon

it. The accident happened near the little prairie, between Memphis and New Madrid. At, or near, Memphis, they had wooded, and had proceeded about twenty-five miles without any thing unusual occurring; there was no boat within many miles of them, and I was assured that they had not the slightest idea either of outrunning a boat below, or of overtaking one above them. Indeed the time consumed in going the 25 miles seems to contradict the notion that the steam was too high, as from the best information it was not short of three hours. There were, I think, eight boilers; that which burst was one of the outside ones, near its centre, and about a foot from the bottom of it, whence it was ripped upwards by the steam a yard or more. One of the persons who saw it, told me that the aperture was large enough to take in a flour barrel. This boiler had a thin place in it which had been cut out the year before, and a new piece put in with *copper rivets*, and in that very place it burst. The boilers had not been cleaned since leaving New Orleans; there had been a freshet in the Missouri, and the water was unusually muddy. There was a sediment at the bottom of the boiler, but my informants differed as to its thickness; that, however, matters not, as they all agree it was baked as hard as a brick, and burnt. These are the facts, and the most probable solution is, that the rivets were burnt off where the sediment attached to the iron.

Since these terrible disasters they are getting much more careful. I am told it was no uncommon thing, a few years ago, to use puddled iron for boilers, when a person came along who beat them down rather more in their prices than they thought they could afford. They have improved their boilers, and now make the heads of *wrought iron*, which unscrew, and are large enough for a man to go in and clean them thoroughly; formerly they placed too much confidence in what they term blowing them out. As long as they keep the boat running, there is no danger from sediment, but if they stop for the night, as soon as the ebullition ceases the sediment deposits, and gets so hard that it cannot be raised again. The boilers require great attention in the western waters, even when the rivers are clear, as they are so strongly impregnated with lime, that an incrustation is formed almost immediately. These facts I think may be relied on: they are derived from the clerk who was in the boat at the time, and who is a man of intelligence, and I should say, of integrity.

I will say a word or two more on your favourite object. No blame, whatever, attached to the captain or officers. The former is now superintending the building and equipping one of the largest and most splendid boats I ever saw. At the moment of the explosion, his brother, the engineer, was standing within a yard of him, and had just tried the gauge cocks, and found the water as it should be. After that moment he never saw him more. The high pressure boats still continue in vogue; indeed, as constructed, on these waters, I think them quite as safe as on the other principle. You are probably aware that there is no such thing as a copper boiler; they are uniformly of wrought iron, generally a quarter of an inch thick. The high pressure engines have a fore and aft motion, which strain them. The

former, too, takes up less room and weighs less, which is an object of great consequence, as they are obliged to use light draught vessels, at least half the year. The one we came down in only drew 14 inches, when light; and 20 inches with 80 passengers and their baggage on board.

(No. VI.)

Letter from a gentleman connected with the Caledonia.

Philadelphia, October 27, 1830.

Dear Sir,—In answer to your inquiry relative to the explosion of the boiler of the steam boat Caledonia, while running on the Mississippi, in May, last, I remark that the explosion was at first attributed to some defect in the iron of which the boiler was made; afterwards to the careening of the boat, in consequence of the passengers crowding on one side; but upon examination of the boiler, and of many circumstances since, it is the opinion of her owners, and of many scientific men, that it was the result of *carelessness.* The engineer, who was killed, had high reputation; but had, upon this trip, neglected to "blow out the boilers." The river was extremely muddy, and the boat was kept in constant motion for about seven days, when some derangement occurred in the machinery, which compelled a stoppage of several hours, (perhaps eight.) This delay caused the mud, which had been kept in motion by the boiling of the water, to settle and become baked to the bottom of the boiler. Upon the application of the fire, the iron was *burnt,* (which is, I believe the cant phrase,) or rendered brittle, and after being out two hours, the explosion took place; the boilers at the time being well supplied, for the engineer had just been trying the gauge of the water. The rent in the boiler was about 18 inches, about one-third distance from the bottom, in the *side.* The boilers were high steam cylinders, about 30 inches diameter, and 20 feet long, with two flues.

The above is, I believe, a correct statement of facts, hastily drawn up, and altogether at your disposal.

Yours respectfully.

(No. VII.)

Letter from Matthew Robinson.

New Albany, Indiana, August 16, 1830.

Sir,—In answer to your letter of inquiry into the facts relative to, and causes of the explosions of steam boilers, I take pleasure in communicating all the information of which I am possessed. The first case to which my attention was particularly directed, was that of the explosion of the middle boiler of the high pressure steam boat Car of Commerce, of 200 tons burthen, with five boilers. The after

head of the middle boiler, which was made of cast iron, seven-eighths of an inch thick, gave way; which caused the boiler to jump from its bed 12 or 16 feet, carrying with it the four other boilers. On examination I found the one which burst was an L flue boiler, the other boilers having straight flues, running through both their heads, which adds much to their strength and safety. The bad construction of this boiler was, in my opinion, one cause of its explosion. Another, and more immediate cause, was the want of sufficient water in the boiler, they having stopped directly before the accident to repair the force pump, at the same time holding on to the steam, that they might be able to overtake a boat which was ahead of them.

The next explosion I particularly noticed was that of the high pressure steam boat Helen M'Gregor, with 6 boilers, 36 inches in diameter, with one L flue, 17 inches in diameter, in each boiler. These were all L flue boilers. The after head of the second one, from the starboard side, having been before cracked, gave way; and this boiler breaking its connexion with the others, went through the bow of the boat into the river. We are satisfied there was sufficient water in the boiler. At the time of the explosion, the engine was in the act of performing its first revolution after wooding at Memphis, on the Mississippi.

The third case was the collapsing of one of the flues of a boiler of the high pressure steam boat Huntress, 300 tons burthen, on her passage from New Orleans to Louisville. The boat had stopped her engine for a few minutes, for some purpose, and it is satisfactorily ascertained that the water was too low in the boilers; when, therefore, the engine was again set in motion, the explosion took place. Whenever the water in the boilers becomes lower than the uppermost part of the boiler with which the fire comes in contact, the part between the surface of the water inside and the aforesaid uppermost part of the boiler becomes red hot, and cold water being at this time introduced, steam is instantly generated in such quantity that no safety valve of the usual dimensions will allow it to escape, and an explosion is the inevitable consequence.

The fourth case was that of the high pressure steam boat Caledonia, on her passage from New Orleans to Louisville. This explosion took place while the boat was steadily running, which makes it differ from most other cases, and we must therefore look for other causes. They are found in the deficiency of the boilers themselves. In the first place, the boilers of the Caledonia are made of iron entirely too thin for boilers forty inches in diameter; but a more special cause arose from a patch put upon the lower part of one of the boilers with copper rivets, and the water in the Mississippi being very muddy, they did not keep the boilers sufficiently clean, but suffered the mud to accumulate too much between the flues and the bottom of the boilers; the mud being baked hard prevents the water from communicating with the iron of the boilers.

From the cases above noticed, as well as others to which my observation has extended, I am clearly of the opinion that all explosions, without exception, are to be attributed either to the careless-

ness of the engineers, or the deficiency of the boilers, and that the power of steam may be completely under the control of the careful and experienced artist. More effectual means of precaution might, however, be adopted; and I will mention one which I consider of much importance, which is, that the number and size of the safety valves should be increased. The boat I am now building, of 350 tons, is to have two safety valves of full size.

I hope you will pardon the delay which has arisen in answering your communication.

I am, with much respect,
Your obedient servant,
MATTHEW ROBINSON.

(No. VIII.)

Letter from Erasmus W. Benton, dated
New Albany, Indiana, August 7, 1830.

GENTLEMEN,—I have been called on by Mr. Robinson, of our place, to state some facts respecting the causes of the explosions which have so often happened on our western waters. As I feel a deep interest in the matter, I give some of the particulars of my observations, experience, &c. In the year 1815 I went on board the steam boat Enterprise as head engineer, and from about that time have been engaged in running or building, repairing, &c. until the present time. I now carry on the New Albany steam engine and sugar-mill establishment. There has been a great number of explosions; some of them I have been called on to examine, and make an estimate of cost, &c.; of a number of others I have done the repairs, and from observation and experience I beg leave to communicate some of my ideas on the subject.

The first I shall mention is the steam boat Constitution, at Point Coupée settlement, in 1817, near St. Francisville on the Mississippi. I was on board a few minutes after the explosion, from the appearance of the boiler it had been nearly dry, and by forcing a quantity of water into it, the head and part of the boiler gave way, and some 13 or 14 persons were blown into eternity by imprudence, neglect, &c. The boilers were made of $\frac{3}{16}$ inch iron, and calculated to carry about 80 lbs. pressure to the inch, and I believe the valve was loaded to more than three times that pressure. There were several others, such as the Atlas, Car of Commerce, and Star, which exploded from similar causes, partly from the want of water, and partly from a deficiency of strength in the machinery. The boiler heads of the Atlas I had taken out last summer, and I found them not more than $\frac{3}{4}$ to $\frac{7}{8}$ inch thick, and that of very imperfect cast iron. The explosions of the Grampus, Union, Porpoise, Huntress, and some others, arose entirely from the want of water in the boilers. The Helen M'Gregor and Tally Ho:—the heads of the Tally Ho's boilers were made of sheet iron, $\frac{3}{16}$ inch thick, and in turning the flanches where

the head is riveted in the end of the boiler, the corner was turned so square as to crack the iron more than half off; one of the heads blew out half the way round and threw the boilers out of their stands, which let the steam escape with the loss of only three persons, as there were but few persons on board. I repaired the boilers by putting in new heads, and I found all of the heads in a very unsafe situation. The Helen M'Gregor's head had been cracked for some time, but as there were so many other boilers in the same situation, I suppose they thought their boilers as safe as others that had escaped. The Caledonia's explosion was occasioned by putting in copper rivets; the iron and copper together will not stand, you find. When wrought iron nails are put through copper flanches, or any other copper, where water comes in contact, the iron will corrode, and in a short time become perfectly loose. There might have been another reason for the explosion of the boilers of the Caledonia; the mud settling under the flue so as to let those rivets get red hot, and copper in that state is of little strength; the boiler iron of itself was scant $\frac{3}{16}$ inch thick, and I believe of very poor quality.

There are several other causes to account for these explosions, besides those which I have stated. When there is a sufficiency of water barely to keep running with safety; if while running, the boat comes too, as is frequently the case, the water wastes very fast, and if the flues do not become entirely dry, they become so nearly so that the water is low on the sides of the boiler above where the fire comes in contact with it; the sides of the boiler become so hot that as soon as the engine is started, the water rises in the boiler, which comes in contact with the hot iron, which generates steam as quick as the explosion of gunpowder. I believe in every instance that has come under my observation, where there was any thing near a sufficient quantity of water in the boilers, it has been the case that in a very few revolutions after the engine has started they have blown up. For example, take a sheet of boiler iron, heat it red hot, and pour water on it, and you will be convinced of the cause. One other cause of explosions is that the cylinders of some boats have become worn by use for some years, so that the packing that is made use of for packing the piston blows out, and with the escape steam works through the force pump and collects in such bodies under the flues, that it sometimes causes the bottom of the boiler and flue to become red hot, as was the case with the Amazon, Herald, Jubilee, and others, but the explosions were attended with less danger.

To guard against those accidents, first, there should be a committee appointed to examine and try the strength of the boiler as often as might be thought practicable, and to give the engineers what weight to carry on their safety valves, and hold the masters, owners, &c. accountable when they carry more weight than what they are allowed; the safety valve, or valves, should at least be as large as the throttle valve, for I contend, that if the boilers are sufficient to keep steam blowing off when the engine is in operation, the safety valve should be large enough to let it escape when lying still with full fires, as is often the case. The safety valves of more than half the boats, now in use

on the western waters, are not more than half the size of their throttle valves, and not more than one-third of the boats have more than one. I have made valves and seats for many of the boats, and I know this to be the fact. You inquire, of what materials the boiler should be made; my opinion is, that good iron is the best for boilers for these waters, because the mud often bakes under the flues, and the iron will stand better when hot than the copper. The old practice of stopping and sending men in the boilers to clean out the mud, has been substituted by blow-off cocks, placed on the stands, or connexions under the boilers, which will answer the purpose for a short voyage, but when coming the distance from New Orleans to Louisville, they make a practice of blowing off once, or perhaps, twice, and I believe in some instances it does more harm than good, for they blow the water out with fire under the boiler, and the mud that is often settled under the flue becomes baked as hard as a burnt brick; I have taken it off when it was almost as hard as the iron itself. The common puppet valve, as now used, I believe to be as good a plan as can be invented. The only difficulty is, that many of the engineers on the river do not know what weight they carry. In the first place, the constructors of engines neither mark their weights nor their levers, and the engineers that run the boats put on old casting, or cord wood, or something else, as long as the valve keeps rising, without any reference to the weight which they should carry. I will give you more particulars hereafter.

Yours,

Erasmus W. Benton.

(No. IX.)

Letter from Matthew Robinson, dated

New Albany, September, 1830.

Sir,—In my answers to your first, which I hope you received in due time, I entered into the particulars of four explosions, all of which were caused by a defect in the construction, materials, or workmanship, or in the management of the engines. In all the explosions with which I am acquainted, say seven or eight, it was, in my opinion, in the power of the most superficial observers to have named the particular cause of the explosion. My opinion is that if they will, for all high pressure engines, have straight flues through, and connecting the two boiler heads strongly together, and those boilers and boiler heads of sufficient thickness and quality, with two force pumps, and two safety valves, for each set of boilers, with experienced engineers, who shall have the whole control of the engine, our printers would be called on to give the unpleasant intelligence of but few, if of any more explosions, and we should no longer hear of the death of human beings by such accidents.

To give you the exact size and relative thickness of our boilers would be attended with difficulty; some of them are 16 feet long, and 28 inches diameter, and are four-sixteenths of an inch thick,

and you will find a set of boilers, 18 feet long, and 40 inches in diameter, and three-sixteenths of an inch thick.

With these remarks, I will refer you for further information to Edward Benton, brass founder, New Albany, and Andrew Watson, engineer of the steam boat Fame at New Albany.

N. B. I have neglected mentioning whether the boilers were of foreign or American iron; I believe they were of American iron generally; this, however I do not consider as the cause, but probably the want of a proper system and of experienced engineers. I have long expected these explosions. I have been 14 years here building or repairing steam boats, during which time I have known several men act in the capacity of firemen one day, and the next day I discovered they had been made engineers; and knowing, as I did, that they were not acquainted with any mechanical branch whatever, I dreaded the consequences. Moreover, I have known a man acting as a clerk in a mercantile house here, this being the only business, I believe, with which he was acquainted; the next day I have seen his name in a hand bill, appointed captain of a steam boat.

Please excuse my writing, and accept for yourself and the success of your investigations, my best wishes.

Yours, respectfully,
MATTHEW ROBINSON.

(No. X.)

Second letter from Matthew Robinson, dated

New Albany, September, 1830.

DEAR SIR,—I received the second circular from the Committee of the Franklin Institute. I agree with the correctness of your remarks contained in it, and if the intelligent part of passengers would devote a portion of their attention to the arrangement and management of the engine, they might, in many instances, discover a want of system. The steam boats in 1817 and 1818, were generally 25 or 30 days on their passage from New Orleans to Louisville; in these last four years they have performed the same passage in 9 or 12 days, consequently they have increased their power more than 50 per cent. yet they have not increased the strength of their boilers in proportion to the height they now carry steam at.

Yours, respectfully,
MATTHEW ROBINSON.

[TO BE CONTINUED.]

Letter from Peter S. Duponceau, Esq., accompanying some cocoons produced on the estate of the Hon. Henry Bry, of Monroe, district of Ouachita, Louisiana, and which were deposited at the Exhibition of the Franklin Institute, in October last.

I HAVE the pleasure of sending you a parcel of cocoons, weighing something less than two pounds, for which I beg you will obtain a

place at the exhibition of the Franklin Institute. These cocoons are all that remain of a large quantity sent to me as a present by the Hon. Henry Bry, of Monroe, in the district of Ouachita, in Louisiana, and are the production of his estate. Although not remarkable for their size, they contain more silk than any I have ever seen, or, indeed, that I have ever heard of in any part of the world. Fourteen pounds and six ounces of them have produced, on reeling, three pounds eleven ounces of fine raw silk; which is about three pounds and three-quarters of cocoons to one pound of silk; which is truly astonishing, when it is considered that in Europe twelve pounds of cocoons are required to produce one pound of silk. I am speaking, it is true, of cocoons containing the live chrysalis; but allowing 25 per cent. which is a large allowance, for the loss of weight by baking, and the diminution during the voyage from the interior of Louisiana to this city, it would still have required on the European calculation, nine pounds of cocoons to produce one pound of silk, whereas that quantity was obtained from less than four. I have witnessed this fact, and can attest it of my own knowledge. You will observe that the cocoons are hard and compact; they reeled off quite to the chrysalis, which fell of itself into the basin, without a single particle of silk. I have thought this explanation necessary in order that the extraordinary excellence of these American cocoons may be fully understood.

The next best cocoons I have received this year, were sent me, also a present, by the lady of Thomas Sumter, Jr. Esq., the son of the venerable General Sumter. They were raised on the family plantation at Statesburg, in Sumter district, South Carolina. Five pounds of these produced one pound of raw silk, and no doubt would have produced more, if that excellent lady had not been confined to her bed by sickness, and could have attended herself to the rearing of her silk worms, as I had some before of her raising which did not yield to those of Louisiana. I have kept none of these cocoons, having converted them all into silk. They were of the large kind, and very beautiful.

I have seen cocoons as fine in their appearance as those I have mentioned, but none that produced so much silk; from whence I infer that our southern districts are admirably calculated for this production.

I have not attempted this year to manufacture any silk, as that is not my immediate object. What Mr. D'Homergue did last year, was only to show what could be done, even without the necessary machinery. Since that time a throwsting mill has been erected at Manayunk, at which I have had some silk thrown, reeled by our women in the second year of their instruction, which has turned out very well, one parcel having given only six per cent. waste, and the other seven, though the cocoons were of an inferior kind. I have given the thrown silk to a manufacturer, to be converted into stuff for silk hats. I mean to make similar experiments with the remainder, availing myself as much as possible of our various manufacturers. I find, however, that their looms, and their carding and other

apparatus, are not exactly suited to the silk manufactures, nor is there yet any complete apparatus for the making of sewing silk. But we are proceeding so fast, that next year, or perhaps before, these inconveniences will have vanished.

I have, therefore, nothing to exhibit this year except these cocoons. I might send skeins of raw silk, as I did last year, but they must either be placed beyond the reach of hands, and then they cannot be well judged of, or they must be suffered to be handled, which soon renders them unfit for use. Besides, the proper test of the value of raw silk is by submitting it to the process of throwing. Silk may appear outwardly very fine, which, in that process, will run to waste.

I am, with great regard and esteem,
Dear Sir,
Your most obedient humble servant,
PETER S. DUPONCEAU.

Philadelphia, October 3, 1831.

P. S. I expect every day, from England, samples of stuffs manufactured from our American raw silk, but it is not probable that they will come in time for this exhibition, which I greatly regret.

Letter from P. S. Duponceau, Esq. to the Editor, on Gensoul's steam apparatus for silk filatures.

Philadelphia, 22nd September, 1831.

DEAR SIR,—In a French work on the subject of the silk trade,* which I lately received, I found a description, accompanied with a plate, of M. Gensoul's celebrated apparatus for conveying, by means of steam, an equal degree of heat to the water contained in any number of basins, employed in a filature of raw silk. Thinking that the publication of this description in the Journal of the Franklin Institute may be of use to our fellow citizens, at a moment when the public mind is actively employed on the subject of the culture and manufacture of silk, I have extracted it from the original work, and have the pleasure to send you a copy of it, and also of the drawing, of which you will make what use you shall think proper.

I am, very respectfully,
Your friend and humble servant,
PETER S. DUPONCEAU.

Report on M. Gensoul's steam apparatus for silk filatures, made to the Agricultural Society of the department of the Rhone, in France. By Dr. Terme.—With a Plate.

GENTLEMEN,—Although you are all well acquainted with Mr. Gensoul's admirable apparatus, still we think it adviseable to lay be-

* Du Commerce des Soies et Soieries en France, par M. Leon de Teste, Avignon, 1830.

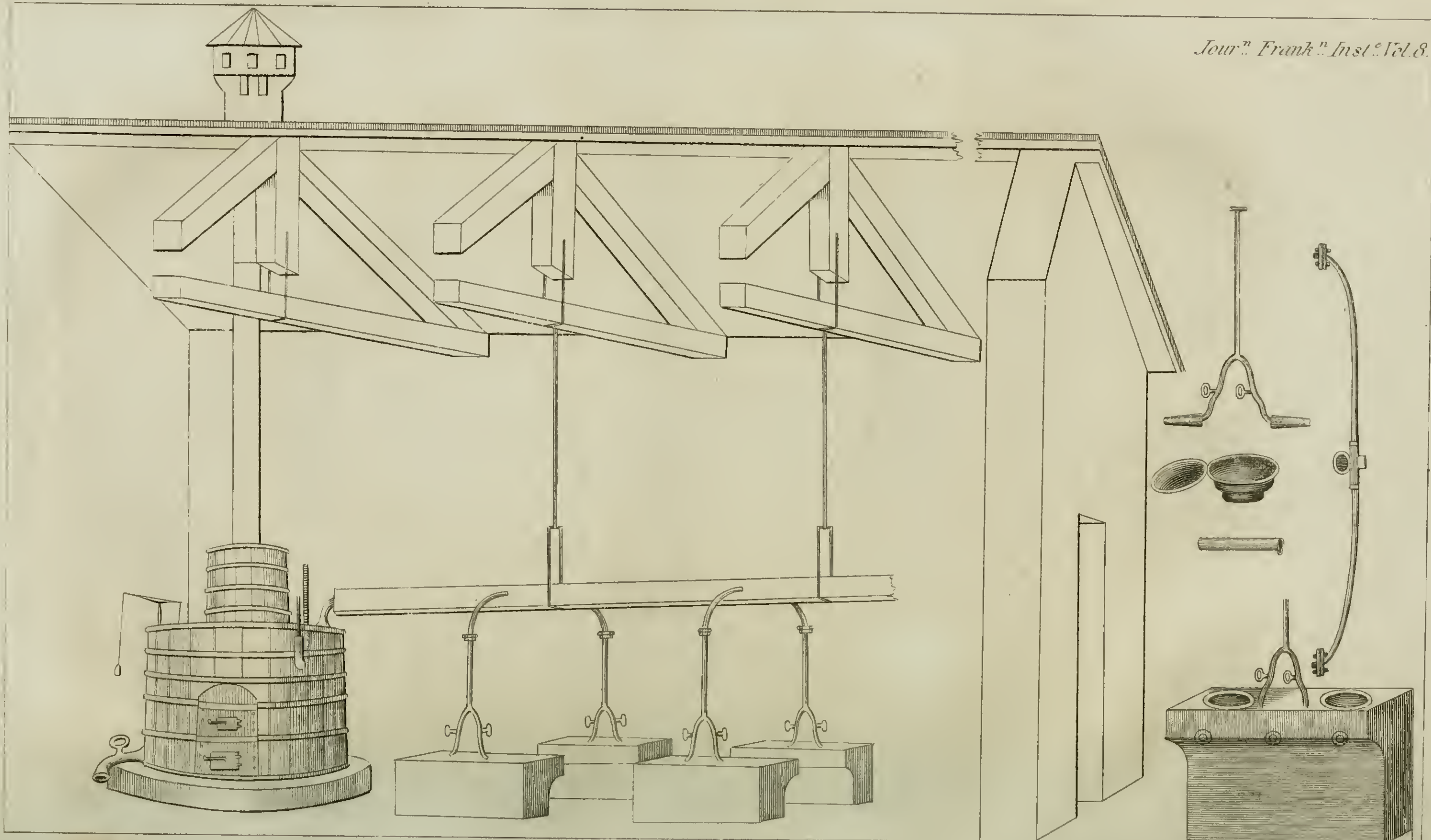
fore you a hasty and general description which will suffice to convince you of its great usefulness. M. Gensoul's objects, and the results which he has obtained, are the diffusion of a sufficient degree of heat from a single furnace to any number of basins—the systematizing of the work of the women employed in spinning—the raising gradually, but with rapidity, the water in the basins to any required temperature, preserving it at the same time perfectly pure—lastly, the increasing the amount of the products of spinning.

The apparatus consists of a boiler provided with a steam gauge and a safety valve; the boiler is placed in a furnace heated by means of bituminous coal.* The steam thereby generated passes into a main pipe which extends horizontally through the whole apartment at an elevation of about ten feet from the floor. From this main pipe, descending pipes branch out laterally; each of these is bifurcated, and supplies two basins with steam. These pipes are terminated by a tube, the extremity of which is perforated with small apertures that allow the steam to diffuse itself through the water in the basin. They are also provided with stop cocks near the end, by opening or closing which, the spinners are enabled to regulate the temperature. When steam is introduced into cold water it produces a hissing sound that continues till the temperature is raised to 167° F. From 178° to 190°, which is the best point for spinning, the water experiences a very distinct tremulous motion, which, at 203° passes into a lively ebullition; this is the proper temperature for beating the cocoons. These indications may serve in lieu of a thermometer, and are so used by the spinners, who being no longer diverted from their occupations by the necessity of keeping up their respective fires, as they used to be, are enabled to attend more steadily to spinning. The steam that condenses in the basins furnishes a constant supply of distilled or perfectly pure water, which gives to the products obtained by this apparatus, a marked advantage over those resulting from the old process. A comparison, made by the committee, of hanks of silk produced by the old and the new apparatus showed the superiority of the latter. By comparing these hanks with some of the first quality of Chinese silk, the committee satisfied themselves of the great and decided preference to be given to that of French origin.

To this report M. De Teste adds: This mode of working by steam, compared with the old process, shows a saving of three-fourths of the fuel, an increase in the quantity of the produce of labour, which may be estimated at one-tenth, and an improvement in the quality and brilliancy of the product. Moreover, by means of it, the white silk retains all its brilliancy.

The new process has been adopted, not only by the spinners of France, but also by those of Piedmont and Italy. The examination which M. Gensoul underwent before the chamber of commerce of Turin, and the experiments made by the members of that chamber, have conclusively established his reputation.

* Anthracite may, we think, be used with equal advantage.—Pub. Com.



Gensoul's. Steam apparatus for Silk filatures

FRANKLIN INSTITUTE.

Quarterly Meeting.

THE thirty-first Quarterly Meeting of the Institute was held at their Hall, on Thursday, October 19th, 1831.

THOMAS FLETCHER, Vice President, in the chair.

ALEXANDER FERGUSON was appointed Secretary, *pro tem.*

The minutes of the last quarterly meeting were read and approved.

The quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on publications, with instructions to publish it in the Journal of the Institute.

Professor A. D. Bache, from the committee appointed by the Board of Managers on the subject, proposed an amendment to the constitution—which was laid on the table until the next meeting.

On motion of Professor A. D. Bache, a committee was appointed to address the Secretary of State on the subject of the Patent Laws of the United States.

Messrs. S. V. Merrick, Alexr. D. Bache, Isaac Hays, and Thos. Fletcher, were appointed said committee.

Mr. W. H. Keating offered the following resolution, which was unanimously adopted, viz:

Resolved, That this meeting have heard with deep regret of the loss which this community has suffered by the sudden death of their lamented associate, Reuben Haines, whose disinterested and zealous exertions in the promotion of science entitled him to their particular respect and esteem.

Resolved, that a copy of this minute be transmitted to his family.

On motion of Mr. C. C. Haven, it was

Resolved, That a committee be appointed to aid the corresponding secretary in ascertaining the number and extent of manufacturing establishments and mechanical institutions in this state, with statistical and general information concerning them, and that they be requested to report the results at a future meeting.

Messrs. C. C. Haven, W. H. Keating, W. R. Johnson, Frederick Fraley, Alexr. D. Bache, Saml. V. Merrick, Thomas Fletcher, Algernon S. Roberts, and James Ronaldson, were appointed said committee.

Resolved, That the committee be requested to direct their early attention to the manufacture of iron in Pennsylvania.

THOMAS FLETCHER, *Vice President.*

Attested.—ALEXR. FERGUSON, *Rec. Sec. P. T.*

Thirty-first Quarterly Report of the Board of Managers of the Franklin Institute.

To the Franklin Institute of the state of Pennsylvania, for the promotion of the mechanic arts, the Board of Managers respectfully offer their thirty-first quarterly report.

The affairs of our institution continue in as flourishing a condition as stated in our former reports. The exhibition, which has just closed, and of which a detailed report will soon be laid before the public, clearly shows that while the Institute retains the vigour and alacrity of its first efforts, it enjoys the confidence that results from years of tried usefulness. The depositors, and the public at large, evince a continued interest in our exhibitions, and the benefits which we know them to produce, offer an incentive to future efforts.

Our experiments on water wheels are in the course of publication, and will, it is presumed, add value to the pages of our journal.

Our experiments on the causes of explosions in steam boilers, still engage the attention of one of our committees.

Our reading room continues in good order, and is slowly winning its way into public favour. Our library and collections occasionally receive valuable accessions.

Our schools and lectures, which were interrupted during the summer season, will soon be reorganized, with increased prospects of usefulness.

The report of our treasurer will show the receipts and expenditures of the last quarter.

We invite our members not to slacken in their zeal to get us an accession of new members. Upon our increase in numbers depends our further development. Much as the Institute has done, there are still many objects deserving our notice, and which the limited state of our finances prevents us from fostering.

Our actuary has returned from a visit to the northern and eastern states, made with a view to extend an acquaintance in those states with the nature of our exhibitions, and solicit the co-operation of their manufacturers. It is believed that his journey has been eminently successful, but that the beneficial effects have not as yet been fully realized.

M. D. Lewis, *Chairman.*

Attest—William Hamilton, *Actuary.*

To the Board of Managers of the Franklin Institute of the state of Pennsylvania for the Promotion of the Mechanic Arts, the Committee of Premiums and Exhibitions, respectfully Report:

That in pursuance of the plan sanctioned by the Board, their seventh Exhibition of Domestic Manufactures was held at the Masonic Hall on the 4th inst., and that it continued open until the 8th, inclusive; during which time, it was visited by an immense number of our fellow-citizens, as well residents of this city as strangers. The committee estimate the visiters to have exceeded 40,000. Notwithstanding the great extension given to free admission, including the members of the Institute, depositors of goods, committees of arrangement and judges, persons connected with the press, and strangers of distinction, to each of whom tickets, admitting three individuals at any one time were issued, the receipts at the door amounted to

$1,218 50, which shows that about 10,000 persons paid for their admission. The expenses of the exhibition were, it is believed, somewhat higher than usual, but the committee entertain a hope that this sum will be sufficient to defray them entirely. The accounts are not yet settled: when this is done, a full statement of receipts and expenditures will be submitted. Among other benefits attending the present exhibition, the committee enumerate an accession of seventy-six members, and the sale of a few copies of the Journal.

But as the objects of the Institute in holding these exhibitions were in no manner of a pecuniary nature, it is to the benefits which they are calculated to produce on our manufactures, that we look as a reward for past exertions, and as an incentive to future ones. It is gratifying to observe the great improvement which each successive exhibition manifests in the manufactures already established, as well as the increase resulting from the new ones now, for the first time, noticed. Among the articles in which most improvement has been made in the last twelve months, we may mention the carpets, the flannels, the printed cottons, the stoves for anthracite, the writing paper, the Britannia ware, &c.

Among those now seen for the first time, are the natural yellow nankeen, the cotton hose, the silk plush, the cutlery, &c.

Great improvement in the taste of the manufacturers is evinced in the chaster and more graceful forms of the cabinet ware, most of the pianos, the grates, and other articles, the good workmanship of which often suffered much, formerly, by the abuse of ornaments. Even now we occasionally observe forms too massive, or inappropriate to the uses expected of the goods—gaudy or inharmonious colours—gildings too lavishly spread upon objects of furniture. But it is gratifying to see the disposition to improve as evinced by many of our manufacturers. Among the articles the good taste of which united all suffrages, we might cite the beautiful Brussels carpets from Lowell and Carlisle, the handsome sofa by White, the admirably executed chandelier of Cornelius, &c.

The committee would observe that while the quality of the goods was decidedly superior to that on former occasions, the quantity and variety of articles were also greater: the only branches in which our former exhibitions presented a richer display, were in cabinet ware, marble mantels, and grates. These are all very cumbersome articles to move; and in the case of the marble mantels, the erection of them is attended with so much expense, that the committee used no exertions to persuade the makers to send them. To this circumstance, and to the highly improved distribution of the goods, introduced by the committee of arrangement, we attribute the greater comfort of the visiters, even during those periods when the rooms were more crowded than we had ever known them to be before.

The committee have pleasure in stating that, with the exception of a few trifling articles mislaid, the goods were all returned in perfect order to their owners.

Annexed, we present, first, a list of the premiums which we con-

sider to be due, and which we recommend to the Board to award—secondly, the catalogue, or invoice, of the goods deposited—and thirdly, the reports of the judges, many of which contain observations which we think will enrich the Journal of the Institute. They appear to have been, for the most part, drawn up with much more care than on former occasions.

Of the eighty-nine premiums proposed by the Institute, fifteen are adjudged to be due; by adding to these the fifteen extra premiums which the committee think ought to be awarded, we obtain the number of thirty, which we respectfully recommend to you to grant. They are as follows:

On Cotton Goods.

1. Premium No. 54, for the best sample of rich chintz prints for ladies' dresses, not less than three colours, and not less than 5 pieces of 28 yards each, is due to Andrew Robison, of Fall River, Mass., for specimen No. 237, deposited by Hacker, Brown & Co., which are remarkable for their firmness, colouring, and elegance of execution.

2. Premium No. 57, for the best sample of two blue prints, (same quantity to be exhibited,) is due to the Eagle Works of Belleville, N. J. for specimen No. 382, deposited by Gill, Ford, & Co., which were the best and finest exhibited, and fully entitled to premium.

3. Premium No. 60, for the best sample of 4-4 fancy gingham, in imitation of the Scotch, of yarn No. 45, or upwards, not less than ten pieces of stripes and checks, of equal lengths, to be exhibited, is due to John Steel, of Philadelphia, for his specimens No. 256, manufactured from yarns from No. 60 to 80. The committee understand that these are the finest yarns at present to be obtained in this market, and that this manufacturer deserves encouragement for the ability and industry which he has manifested.

4. Premium No. 49, for the best sample of white Canton flannel, 26 inches wide, not less than 200 yards to be exhibited, and to be superior to any before offered, is due to the Blockley works of Philadelphia, for specimens No. 34, which were the best exhibited.

5. An extra premium is due to John Colt, of Paterson, N. J., for specimens No. 187, deposited by Craig and Sargeant, being six pieces of cotton canvass, which the committee consider to be an object of great importance to the country. The experiments made on board of public and private ships, have established its character, and the attention of the public cannot be too frequently called to it.

6. An extra premium is also due to the Hon. John Forsyth, of Augusta, in Georgia, for the spirit of enterprise which has induced him to cultivate the variety of cotton from which the Aerumna nankeens were made. These goods, (No. 104,) deposited by Thomas & Martin, manufactured by Collet & Smith, of Paterson, N. J., are deserving of particular notice, as the colour is said to stand the severest tests, and as the extension of this variety of cotton bids fair to supply us with an excellent substitute for the Indian yellow nankeens.

7. In like manner an extra premium is due to Collet & Smith, of

Paterson, N. J., for the skill and ingenuity manifested by them in the manufacture of these nankeens, and for the success with which they have overcome the difficulties arising from the shortness of the staple, &c.

8. An extra premium is also due to Cunningham & Anderson, of Richmond, Virginia, for specimen No. 415, deposited by Hacker, Brown & Co., being their Brochellas, dyed blue in this city. They are well calculated for a cheap wearing apparel, and being stout and well made, will supply a desideratum which has been anxiously looked for. These are also interesting to us, as being the first specimens of cotton goods received from a manufactory south of the Potomac; these five pieces were found in the warehouses in this city, and not sent expressly by the manufacturers, they may, therefore, be inferred to be a fair specimen of the goods they make.

9. Although premiums No. 63 and 64 are not strictly due, yet the committee think that the Newburyport Hose Manufacturing Company deserve a medal for their extensive display of cotton and worsted hose and drawers, Nos. 220 and 221, deposited by A. Wright; they are the first of the kind exhibited here in any quantity. They are substantial and well made, and deserve encouragement, as constituting another branch of cotton manufacture in this country.

Honorary mention is due to Cornelius Vancourt, a pupil of the Pennsylvania Institution for the Deaf and Dumb, for the beauty, fineness, and finish of the checks, No. 28, exhibited by that praiseworthy Institution. They are the best presented this year, but are precluded from the premium, because checks equally good have, at former exhibitions, been presented by the same institution and rewarded with a medal. The committee understand that Vancourt is only 14 years of age, and has been but a short time in the weaving department of the Deaf and Dumb Institution.

To Joseph Smithurst, of Philadelphia, they also award an honorary mention for his jaconet cambric handkerchiefs, No. 334, which are woven of the best yarn now in the market; they are well made and deserving of notice.

Woollen Goods.

10. Premiums No. 73 and 74, on superfine blue and black cloth, and on $3 blue cloth, are withheld; but the committee believe that an extra premium is due to the Oxford Manufacturing Company, of Massachusetts, for specimen No. 23, deposited by C. C. Haven, of which the judges report, that "it is said to be of American wool; that it is the best specimen of cloth at $4 per yard, which they were called to examine; and that it will vie with any of foreign manufacture, as to texture, finish, and mixture, in all of which it bears ample testimony to the skill and ability of the makers."

11. Premium No. 78, for the best sample of fine white gauze flannel, is due to J. & T. Kershaw, of Blockley, Pennsylvania, for No. 53, which was the finest specimen of this article that had ever come under the notice of our judges: the wool is of the finest description, and the goods are remarkably well made, the only objection being a

slight bluish tinge which should be obviated in any future manufacture of the article.

12. An extra premium is due to the Salisbury Manufacturing Company, of Massachusetts; for specimen No. 22, deposited by C. C. Haven, being a great variety of flannels, exhibiting all the different kinds and qualities made by them, and showing a decided improvement in their manufacture; in the opinion of the judges they are in every respect equal to the imported article. The scarlets were particularly rich and brilliant in colour.

13. An extra premium is due to Joseph Ripka, of Philadelphia, for his green summer cloth, (No. 141,) cotton and worsted; the only imitation of the English, of this description, which has come under our notice. We consider this manufacturer as deserving of especial commendation, as well for this particular article as for his manufactures in general, which stand deservedly high in all the markets of the Union.

14. Premium No. 62 is awarded to the Middlesex Manufacturing Company of Lowell, Mass. for their merino cassimere, (No. 111,) deposited by Lewis and Whitney, made of cotton and wool. It is the best specimen of men's summer wear exhibited, and is in every respect equal to the imported article; evincing great perfection of texture and finish, as well as superior style in putting it up.

15. Premium No. 84, is due, we think, to the Buffalo Manufacturing Company of New York, for specimen No. 24, deposited by C. C. Haven, being two pair of white Mackinaw blankets, which will, in every respect, compete with the foreign article.

An honorary mention is also due to the same company for a large parcel of bed blankets, No. 469, which are considered equal to the best English blankets.

16. An extra premium is due to Col. John E. Colhoun, of Pendleton, South Carolina, for the specimens of blankets, (No. 542,) manufactured by him. The warp is of cotton, and the filling is of wool. These are very good samples of a coarse but substantial article, calculated for the use of negroes on plantations, and better than English goods of the same description. This, being the first manufactory of the kind established in South Carolina, deserves encouragement.

An honorary mention is due to Houston & Green of Groveville, N. J. for specimen No. 188, being five pieces of mixed satinets; the mixtures of which are remarkably well done, the fabric strong, and well cleaned from impurities and free from imperfections.

Carpets.

17. Premium No. 81, for the best sample of Venetian carpeting, is due to John M'Fee, of Philadelphia, for specimens Nos. 7, 8, and 9, being three pieces of 5-8 3-4, and 4-4 Venetian carpeting, which is a superior article, and the best of American manufacture that our judges had seen.

18. Premium No. 82, for the best specimen of Brussels carpeting,

is due to Samuel Given, of Carlisle, Pa. for specimen No. 21, deposited by John Hastings, being a piece of handsome and durable Brussels carpet, entirely of American material and manufacture. It is of excellent quality.

19. An extra premium is due to the Lowell Company, of Massachusetts, for the handsome display of Brussels and ingrain carpets, (Nos. 5, 6, &c.) deposited by C. C. Haven. The Brussels are made of foreign yarn, dyed in this country. The patterns are very handsome and tasteful, and the quality remarkably good. The ingrains are of superior quality but not exclusively of American materials, the warp having been imported in the grease. Were these carpets exclusively of American manufacture and materials, the premium would be due to them as a matter of course; and under existing circumstances we think that company has a just claim to a medal.

An honorary mention is due to Isaac Macauley, of Philadelphia, for his beautiful piece of painted floor cloth, (No. 432,) equal in texture and beauty to the English; as well as for his oil cloths for table covers, (431 and 432,) superior to any imported. We should not hesitate in recommending them for premium, if Mr. Macauley had not already twice received the medal of the Institute for similar goods. His manufacture needs neither praise nor encouragement from us, but we cannot withhold the expression of our admiration at the perfection which he has attained.

We also recommend an honorary mention to Doggett, Farnsworth & Co., of Philadelphia, for their beautiful hearth rugs, (No. 37,) which are much superior both in texture and workmanship to any other of American manufacture which we have ever seen.

An honorary mention is also merited by William Perry, of Philadelphia, for his cotton carpets, (No. 96,) which are a low priced article, superior to any of the kind we have yet seen—and to C. Lachapella, of Philadelphia, for his ingrain carpets, No. 99.

Silk Goods.

Although the display of silks was very pleasing, and evinced increasing interest in this department, yet nothing was offered which deserved a premium. An honorary mention is, however, due to Joseph Ripka, of Philadelphia, for a specimen of black plush, (No. 146,) made of American silk, with but a small admixture of foreign material. It is remarkable for the quality of the silk, the excellence of the manufacture, colour, &c.

Straw Bonnets.

20. Premium No. 83, for the best sample of straw bonnets, is due to Mrs. Elizabeth Henley, of Philadelphia, for an article, (No. 191,) far superior to any exhibited here before. The judges united with the visiters in bestowing upon it unqualified praise.

Iron and Steel.

Specimens of both these articles were received; the committee are not prepared to express their opinion as to their merits, as they

are still in the hands of the judges undergoing a severe and thorough examination; but the committee think that an honorary mention is due to Hardman Philips, of Philipsburg, Centre county, Pennsylvania, for the industry and skill with which he pursues his experiments on the manufacture of iron. They leave no room to question the advantages to our country of the introduction here of the improved European process of manufacture. The interesting collection, (No. 302, et seq.) of coal, coke, hematetic iron ore, pig metal, bloom, wire, and screws, entitle him to the notice of the Institute. They were deposited by A. M. Jones.

Cutlery and Surgical Instruments.

21. Premium No. 38. For the best set of table cutlery, to consist of not less than 51 pieces, is due to Henry Barton, for his handsome display of table cutlery, No. 192, to 195, including 162 pieces, or three sets, all equally well made, and which the committee are assured were altogether forged and made in this country.

Hardware.

22. An extra premium is due to the Taunton Britannia Manufacturing Company, of Massachusetts, for its handsome display of Britannia ware, (specimen No. 1.) It is, in every respect, a superior article, and was frequently mistaken for a more costly metal.

Honorary mentions are due to Day & Shock; to M. Katez, and to Job Baker, for their improved locks, the merit of which, noticed at previous exhibitions, has been confirmed by the personal experience of them by the judges; they consider them superior to any other kinds ever imported into the country, but still somewhat deficient in the lackering.

Honorary mentions are also due to Robinson, Jones & Co., of Attleborough, Massachusetts, and to J. M. L. & W. H. Scovill of Waterbury, Connecticut, for their buttons. They formerly received a premium for similar articles. Messrs. Robinson, J. & C., exhibited buttons in quantities of not less than 300 gross. There is no branch of industry in this country, the merit of which is at present so well established, as that of buttons; the great improvements made in their manufacture during the last year, have placed them upon the most permanent footing. Consuming a considerable quantity of the gold produced by our southern states, they have almost driven the English article from the market, and have completely overcome the prejudice which too often attends the first use of our own manufactures.

An honorary mention is due to Jacob White, of Philadelphia, for his planes.

Silver and Plated Goods, Glassware and Porcelain.

The great perfection to which our silversmiths have attained renders it inexpedient for the Institute to bestow its medals upon this branch of the arts; otherwise a fine competition from the extensive workshops of Thomas Fletcher, Edward Lownes, Curry & Preston, and R. & W. Wilson, all of Philadelphia, would have produced

much embarrassment on the part of the judges in deciding upon their respective merits. The Institute is under great obligations to these gentlemen for a really splendid display of the choicest silver urns, tea and coffee pots, cans, wine coolers, castors, cake baskets, goblets, pencil cases, &c.

In like manner the magnificent assortment of glassware from the New England Glass Manufacturing Company, of Massachusetts, from the Union Glass Company, of Kensington, Pennsylvania, and from Jackson & Bagot, of New York, as well as the beautiful display of porcelain ware by Messrs. Tucker & Hemphill, of Philadelphia, show that all these establishments maintain the high reputation which they have already acquired, and fully justify the encomiums and medals awarded to them at our former exhibitions.

Among the less showy but not less useful articles, is the durable and cheap flint stone ware of Horner & Shirley, of New Brunswick, New Jersey, which are likewise deserving of honorary mention.

The porter bottles, made by the New England Glass Company, and deposited by Mr. Muzzy, are undergoing an experiment in order to determine their strength and merits. Until this is completed, we forbear to express any opinion on the subject.

Stoves and Grates.

23. Great interest has been manifested by the depositors and visiters at the exhibition, as well as by the public at large, to ascertain the decision in relation to the stoves entitled to the high reward in premium No. 3, consisting not only of the usual silver medal, but also of the sum of one hundred dollars, which, by the liberality of the proprietors of the anthracite mines in Pennsylvania, was placed at the disposal of the Institute.

By the award of the highly respectable judges to whom this subject was referred, the premium is due to Powell Stackhouse, for his cast iron cooking stove, (No. 534,) which is neat and compact, and will be very durable. It bakes and boils well, and the whole arrangement is good. Its fixtures are well made, and consist of a large tin boiler for washing, a tin boiler and steamer for meat and vegetables, and a tin tea kettle; to all of which copper tubes are attached, which pass through orifices made in the back and side of the stove, over the fire, and from which an abundance of heat is communicated to the contents of the several vessels. Under the grate is a convenient permanent sifter to separate the ashes from the coal. The stove will weigh 1 cwt. 2 qrs.; and, with the fixtures as above, will cost fifteen dollars. It combines greater advantages than any now in use, and the fumes of the anthracite are not brought into contact with the food intended to be cooked. It, therefore, comes strictly within the terms of the premium, except that the price is 15 dollars, and not "*under* 15 dollars," as proposed; but your committee unite with the judges in recommending to the Board to overlook this slight discrepancy, and to award to Mr. Stackhouse the silver medal and the one hundred dollars, as soon as he shall have given satisfactory security to furnish within six months from this date, if required, fifty stoves, of similar construction and workmanship, at that price.

Lamps.

24. Premium No. 24. For the best and most extensive variety of mantel, astral, or hanging lamps, is due to Christian Cornelius, of Philadelphia, for his fine display of excellent lamps, but more especially for his splendid chandelier, (No. 364,) which is believed to be the largest and most tasteful work of the kind that has ever been made in America. It combines large size with perfect proportion and exquisite workmanship.

Books, Paper and Stationary.

25. Premium No. 19 is due to Robt. Donaldson, of New York, for specimen No. ——, being ten reams, (part of one hundred reams manufactured,) of quarto post paper, which was the best presented at the exhibition, and superior to any which the judges recollect having seen at any of our previous exhibitions.

Mr. Donaldson, also exhibited a fine assortment of foolscap, letter, scented, tinted, and embossed note and letter paper.

26. The committee also recommend that an extra premium be given to the Brandywine Manufacturing Company for their beautiful display of paper, (No. 392,) deposited by Thomas Fisher, which is deserving of great praise for its excellent quality and various beautiful tints, as well as for the neatness with which it is put up. We think it due to the manufacturers to state that it was not made with a view to competition.

An honorary mention is likewise awarded to J. Edgar, of Philadelphia, and to David Fell, of New York, as well as to J. Crissy, of Philadelphia, for their good specimens of book binding.

Cotton Seed Oil.

27. Premium No. 14 is due to Joseph M. & George Truman, of Philadelphia, for their purified cotton seed oil, (Nos. 16 and 17,) which is a new and successful attempt, and likely to become a very important article of trade.

Fine Arts.

28. Among the works of fine arts, few come before this society; but of those deposited at our exhibition, the wood cut engravings of objects of natural history, by Reuben S. Gilbert, (No. 179,) have appeared to us to entitle that young and estimable artist to the notice of the Institute; and we accordingly recommend that the silver medal be awarded to him.

Cabinet Ware.

The only sideboard offered to us was one by our fellow member of this Board, Charles H. White, (No. 404,) who, of course is not a competitor for a premium, but being assured that it is the sole and exclusive work of his foreman, David H. Bell, we recommend that an honorary mention be awarded to the latter for his beautiful workmanship.

The highest praise is also due to Michael Bouvier for a beautiful

globe work-table, (No. 323,) the design of which is new, and the workmanship exquisite. The handsome specimens of work from Joseph Barry, and from Anthony Quervelle fully sustain the high reputation of these regular contributors to our exhibitions. The secretary and bookcase, (Nos. 125 and 126,) made by an apprentice to Thomas Robertson, entitle the maker to an honorary mention, as they form a remarkable piece of work for one who has not yet been two years at the trade; they are veneered with our native ash. It is not our purpose to notice the splendid furniture deposited by Mr. White, as his situation in the Board precludes us from paying him any compliment.

Balances.

We deem it just to award an honorary mention to J. Marshall, of Philadelphia, for a highly finished balance, (No. 515,) of the more delicate kind used by apothecaries. The judges report that when loaded with an ounce avoirdupois, it has proved sensible to less than one-fiftieth part of a grain.

Thermometer.

We also recommend that an honorary mention be awarded to Joseph Fisher, of Philadelphia, for his self-registering thermometer, (No. 311,) the beauty of its execution having been specially noticed by the judges on Philosophical apparatus.

Musical Instruments.

29. An extra premium is due to E. N. Scherr, of Philadelphia, for his harp guitar, (No. 345,) a new instrument, made and patented by him; and for his phyzharmonica, (No. 344,) which is an instrument deserving of particular commendation, being well adapted for the parlour or hall, of sweet yet powerful tone, and of beautiful workmanship.

30. To Francis H. Smith an extra premium is due for his Metrotone, (No. 198,) and for his grand harmonicon, (No. 19.) The former is an instrument of ingenious contrivance, capable of describing, to a well cultivated ear, thirty-six distinct sounds in one semi-tone. The latter, better known as the musical glasses, is a pleasing instrument, differing essentially from, and superior to, the musical glasses heretofore invented. The quality of the tone is rich, and with its sweetness combines great power.

Honorary mentions are due to Messrs. Loud & Brothers, J. J. Mickley, C. Meyer, and E. N. Scherr, of Philadelphia, and —— Geib, of New York, for a fine display of their pianos, sustaining well the justly acquired reputation of these able manufacturers.

It is with reluctance that the committee find themselves compelled to omit noticing many beautiful and ingenious fabrics which commanded the attention and elicited the admiration of the visiters; but they are precluded from doing it by the great length of this report. They will be all recorded in the catalogue of the exhibition now in the press.

The Board cannot, without injustice to their feelings, omit to tender the thanks of the Institute to those numberless friends who kindly undertook the arduous duties of the Committee of Arrangement, or the more unpleasant ones of judges: to the depositors for their libelra and enlightened co-operation in the views of the Institute; and to the public in general for the interest they manifest in our efforts, and of which so striking a proof was given by their favourable notice of this, our seventh, exhibition.

The committee have the pleasure of informing the Board that they have succeeded in obtaining the requisite number of medals for this exhibition, and that they will be ready for distribution within a few days after the award by the Board; that is to say, as soon as the names of the successful competitors can be cut upon them.

The committee expected to be able to announce that one of the most distinguished friends of manufactures, in Pennsylvania, had acceded to their invitation to deliver an address to the public on the occasion of the distribution of the medals; but motives of delicacy on his part, of which they cannot but approve, however much they may regret their effect, have induced that able friend of ours to decline the invitation, at least for the present.

All of which is respectfully submitted, by

William H. Keating,	Joshua G. Harker,
Samuel J. Robbins,	Alexander Ferguson,
James Ronaldson,	J. Henry Bulkley,
M. W. Baldwin,	Isaiah Lukens.
Fredk. Fraley,	

At a meeting of the Board of Managers of the Institute, held October 13, 1831, the above report was read and accepted; and, on motion, it was

Resolved, That this Board approve of the award of premiums and honorary mentions recommended by the committee of premiums and exhibitions, and it was ordered that the report be published under the direction of the committee, and that the silver medals be delivered to the successful competitors, as soon as possible, and in such manner and form as the committee of Premiums and Exhibitions shall decide upon.

(Signed,) M. D. Lewis,
Chairman of the Board of Managers.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1831.

With Remarks and Exemplifications, by the Editor.

Continued from p. 253.

11. For a *Thrashing Machine;* Rinaldo P. Gillet, Victor, Ontario county, New York, June 13.

The patentee informs us that the difference between this machine and its predecessors, consists in the manner in which the teeth are

set in the cylinder, and in the mode of gearing. The teeth are made in the form of staples, the two ends of which are to be driven into the cylinder. The machine is to be geared three times, instead of twice, and the wheels are to be larger than ordinary.

The making the teeth in the form of staples has been previously patented. As to gearing, we presume the object is to gain the requisite speed, and in this we have never heard that there was any difficulty in the machines now in use.

---

12. For improvements in the *Manufacturing of common wooden and other Clocks;* Orsimus R. Fyler, Chelsea, Orange county, Vermont, June 13.

The improvements described in this specification are three in number, as will be seen by the claim, which is in the following words—"What I claim as new in the above described apparatus, and for which I ask a patent is, first, the escapement; in this I claim the attaching of the spring, or springs, forming the pallets, in the manner, and upon the principle above specified, at, or near, the centre of the shell of the verge, and the giving to that end which acts as a horizontal pallet the curvature which produces the advantage before described, of increasing, with the spring of the pallet, the acuteness of the angle with which it acts upon the crown wheel. I also claim the guard constructed in the manner and for the purposes herein described and represented."

"I claim the employment of two hammers striking the bell alternately, by the action of the same pin wheel. And I also claim the employment of a roller, bearing upon the second coil of cord, for the purpose set forth in this specification."

The pallets are formed of thin watch spring, which, from their elasticity, and the form given to them, are intended to take off friction as they escape, without the use of oil. The patentee states that springs were used and patented by Jeremiah Dewey, for the same purpose, and describes the difference in the two applications.

The second improvement is in the striking part; in this, the same pin wheel acts upon two hammers, so that the bell is struck twice by the same gearing and motion which in other clocks produce but one blow. The hammers are made to form a counterpoise to each other, and only about one-half of the usual motion of the fly, and of the motive power is required.

The third improvement is designed to remove the objection to a double coil of cord upon the barrel; the ordinary effect of which is to increase the power and action when the second coil is on. This is effected by a friction roller, called a drag, placed parallel to, and almost in contact with, the barrel; it, however, is sufficiently distant not to touch the first coil of cord, but it bears upon the second, and being sustained upon a spring, is made to act with the force necessary to check the motion, so as to counteract the effect of the increased diameter. A spring alone, it is observed, may be made to produce the same effect.

13. For machinery for *Washing Rags in the manufacturing of Paper;* David Ames, jr. and John Ames, Springfield, Hampden county, Massachusetts; assignees of Samuel Eckstine, Philadelphia, June 13.

(See specification.)

---

14. For an improvement in the *Mode of constructing the Standing Press;* Charles Evans, Philadelphia, June 13.

(See specification.)

---

15. For *Combined Steelyards;* Martin Rush, Monroe county, New York, June 13.

Two steelyards are to be taken, and combined together by hooking the shorter end of one to the longer end of the other, the two thus forming a system of compound levers. The patentee tells us that by this means a poise of one pound may be made to weigh several tons. We presume, however, that it will be found necessary to use other than common steelyards when the weight is to be greatly increased, and we know that this mode of weighing will be very far from accurate. The trifling distance through which the small weight or poise will pass, and the increased friction, will present obstacles which those used to accurate weighing can readily appreciate.

---

16. For a *Self-adjusting Drilling Machine,* for drilling stones; Jonathan Crane, Schenectady, New York, June 13.

This machinery is intended, principally, to be employed in drilling the stone blocks used on rail-roads. A frame is made, which, when the drills are to be worked by the power of a man, may sustain four drills, in a vertical position. The frame is to be placed upon the blocks to be drilled; when, by turning a crank, fixed to a shaft and carrying the necessary gearing, stampers, or trip hammers, are made to strike upon the heads of the drills, whilst they are turned round by endless screws properly fixed for that purpose. The face of the drill, instead of the ordinary double bevelled chisel, is to resemble two or three carpenter's chisels uniting in its centre. The patentee apprehends that a chisel with a single bevel will cut much more rapidly than the other forms, if, as in the present instance, the drill is constantly turned in one direction.

The claim is to the application of stampers, or trip hammers; the use of a spring above the stampers, and the peculiar construction of the drills.

---

17. For an improvement in the manner of *Balancing, or adjusting, the upper stone, or runner, of a pair of mill stones;* called a self-adjusting balance iron, for mill stones; Mark Lane Chase, Baltimore city, June 13.

(Specification to be hereafter published.)

18. For a mode of *Purifying and Beautifying of Sperm and Whale Oils;* John L. Embree, city of New York, June 13.

A solution of caustic potash is to be added to the oil, in the proportion of about six ounces to the gallon. The mixture is to be agitated, and exposed to the sun and air for a few days; when, it is said, the mucilage and colouring matter will be precipitated, and the oil rendered sufficiently pure for combustion.

---

19. For an improvement in the mode of *Making Wood Buttons,* commonly called dead-eyed wood buttons; De Grasse Fowler, Bradford, New Haven county, Connecticut, June 13.

The object of this invention is sufficiently designated in the claim, which is to "the addition of a metallic rim, or edge, to the common wood buttons now used for suspenders," &c. This rim leaves the wood bare in the centre, which is then to be drilled in the usual manner for attaching the button to the clothes.

---

20. For an improvement upon, or addition to, his combination of liquids as a *Substitute for Oil in the production of Light;* Isaiah Jennings, city of New York, June 13.

(See specification.)

---

21. For a *Washing Machine;* Samuel Jinkham, Enfield, Hampshire county, Massachusetts, June 13.

The dasher of this washing machine is made in the usual form of those which are suspended to a frame, and which are usually made to vibrate like a pendulum; but in the present case it is placed in a trough, in which it is made to slide from end to end. This is effected by placing a rack on the top of the dasher, and using a segment wheel or pinion, which is worked by a lever, to move it. The clothes, placed in each end of the trough, are thus squeezed between the dasher and the trough.

The patentee tells of many variations which may be made in his machine, but makes no claim to any part.

---

22. For a *Machine for dovetail tongueing and grooving, planing, and sticking mouldings* on piles, planks, boards, &c.; John Judge, Navy Yard, Washington city, June 13.

(The specification will appear in the next number.)

---

23. For an improvement in *Gun and Pistol Locks;* Abel Judson, New Lebanon, Columbia county, New York, June 13.

In these locks the guard and trigger are attached to the plate of the lock, which is to be affixed to the under side of the barrel and stock. The locks are of the percussion kind; the hammer strikes below, and the lock is attached to the stock by a screw passing from

the upper side, through the breech pin, and into the plate which sustains the different parts of the lock.

The claims are to the arrangement of the several parts of the lock, and the uniting of them to the plate; to the making the dog operate both as a dog and spring, and to the manner of attaching together the lock, stock and barrel.

---

24. For an improved *Machine for Shelling Corn;* David Hitchcock, city of New York, June 13.

This resembles those well known shelling machines which have a cast iron disk, furnished with furrows or teeth, and are made to revolve vertically by turning a crank. It differs, however, in many particulars; its operating side, instead of being flat, is made convex, being a segment of a large sphere. The furrows, or knives, are peculiarly arranged; the hopper for the corn is improved in its structure, and there is a contrivance for preventing the too rapid revolution of the corn in shelling, which cannot be intelligibly described without a drawing. A plate of about 15 inches in diameter is accounted a good size; the whole machine, therefore, will occupy much less space than those heretofore made.

---

25. For a mode of *Hardening Hat Bodies on the cone;* Stephen Hurlbut, Glastonbury, Hartford county, Connecticut, June 13.

The cone on which the bat or web that forms the hat body is wound, is made hollow, and perforated with holes. This cone is placed upon a bench so constructed that steam may be admitted into it, and pass through its perforations to the body. This latter is covered with a cloth, and a cap fitting the cone is worked up and down over it by means of a shaft and crank. The description given is meagre and obscure, but, by the aid of the drawing, the general plan of operating may be made out.

---

26. For an improvement in *Candle Moulds,* called the sliding mandrel candle mould; Thomas Hewitt, city of Philadelphia, June 13.

We formerly described a candle moulding machine invented by the present patentee, and the machine now patented does not essentially differ from that alluded to, excepting in one particular, which is specifically claimed. The lower ends of the moulds are to be left open the full size of the tube; into each of these openings a cylindrical mandrel, or plug, is fitted, which will slide easily within the mould, and is perforated so as to allow the wick to pass through it. These mandrels, or plugs, are fitted to a rail below the moulds, one of them passing into each rail, and forming its end. When the tallow has been poured, and has set, the rail is raised, or the moulds lowered, by means of a rack, which causes the mandrels to force the

candles sufficiently from the moulds to allow them to be readily drawn.

---

27. For *Twisting Penny Plugs of Tobacco;* John J. Heriges, city of Philadelphia, June 13.

These *penny plugs*, consisting of pig tail tobacco, are to have the two ends tucked in, in twisting, in a way particularly described, and are then to be rolled under a board, so as to form a neat cylinder. The tobacco is afterwards to be packed and fermented, when it is ready for use.

---

28. For a *Rotary Steam Engine;* Ebenezer R. Hale, Hyde Park, Dutchess county, New York, June 13.

This rotary engine is almost a perfect fac simile of the rotary pump patented by Messrs. Hale and Bell, in July, 1830, and published in our 6th vol. p. 305. The main difference is in the employment of two of the small wheels, marked B, in the drawing accompanying that specification. It may, in fact, be said of the greater number of the rotary steam engines, that they are better adapted to the raising of water, than to the purpose to which their inventors have destined them; they having hitherto been found unequal to the ordinary reciprocating engine, after the test of long continued use.

---

29. For a *Machine for Shelling Corn;* William Hoyt, Vernon, Jennings county, Indiana, June 13.

This patent is taken upon an amended specification, the machine having been originally patented on the 29th of April, 1828. It is essentially the same with the original shelling machine, invented more than twenty years ago, operating by a cylinder, from which spikes, or teeth, project, and act upon the corn against an elastic concave, or apron. The claims now made are to the manner in which the cylinder rests upon the bridge trees; to that in which the bridge trees rest upon the frame; and in which the springs are attached and operate on said bridge trees to give them elasticity, so as to admit ears of corn of different sizes.

The difference between this machine and those formerly patented is so slight, as to be a mere matter of arrangement; springs may be arranged in so many ways, to allow the requisite play to the cylinder, or apron, that a claim, founded upon any one in particular may be easily avoided, without being evaded.

---

30. For a *Fastening for Window Shutters, and Blinds;* William H. Mackrell, Bushwick, Kings county, New York, June 13.

A plate, with a slot or mortise through it, is screwed on to the blind, or shutter, through which there is also to be a mortise corre-

sponding with that of the plate. Two separate catches project from the plate, one of them to catch on a fixture in the wall, the other on a fixture in the window frame. These catches or drops, are "placed in such a manner that the inside catch or drop which makes the shutter or blind fast to the sill of the house, by lifting the inside catch or drop, will lift the outside drop or catch; and the outside drop or catch, which will make fast to the catch secured in the house, will not lift the inside drop or catch, when the shutter or blind is shut." The making them thus constitutes the claim. The object to be attained is not explained, but it must be to prevent the inside catch from being lifted, by that on the outside, when the shutters are closed.

---

31. For an *Apparatus for Distilling and Evaporating;* Alexander Matthews, Island Creek, Jefferson county, Ohio, June 13.

This distilling apparatus is so very imperfectly described and figured, that we have found the attempt to understand its structure to be altogether unavailing. The boilers in which the beer, or water, is to be heated, are boxed round with wood; and as these boxes are rectangular, we suppose that the boilers are so also. There are three of these boxes, two of which stand in a line below, whilst the third, used as a heater, is placed above. The fire is to be conducted under the two lower boilers, and then by a tube through the upper one, which, with the exception of a flue passing through it, appears to be made altogether of wood. Tubes, supplied with cocks, lead down from the heater into this boiler below. The claims are to some things which are not represented, or which we cannot perceive, and our insertion of them, therefore, would not aid the reader in understanding the invention.

---

32. For a mode of preparing *Ardent Spirits from Grain,* &c. and of employing the residuum; Isaiah Jennings, city of New York, June 13.

(See specification.)

---

33. For making *Ornamental and Useful Articles from Anthracite* or Bituminous coal; Josiah W. Kirk, Schuylkill county, Pennsylvania, June 13.

The title of this patent sufficiently indicates its nature; we think, however, that the patentee would have done better had he confined his claim to anthracite, as from some species of bituminous coal, ornaments of various kinds have been made. Jet, is a light species of bituminous coal; and from the well known cannel coal, snuff boxes, columns, mantel ornaments, and various other articles have been formed, as it bears a high polish. The anthracite, in the hands of the present patentee, has, it is said, been wrought into forms of great beauty.

34. For a *Churn;* Philip H. Kimball, Salem, Essex county, Massachusetts, June 13.

This churn is to be a square box, measuring about 12 inches in the clear. There are to be three dashers, instead of the one usually employed, all attached to the same shaft, at a small distance from each other. The dashers are to be worked up and down by means of a lever fixed exactly like a pump handle. The claim is to the use of this lever. The patentee says, "I claim as my invention and improvement the application of the lever to the process of churning, and in the foregoing specification I have described the manner in which I have applied it." There are more than fifty patents for churns in which the lever is applied in various ways, and we cannot discover any novelty in the mode described; but, this apart, it will be seen that the claim is to the lever in general, and not to the mode of applying it.

---

35. For a machine for *Separating Grain, Rice, Peas, Grass-seed, Flaxseed, &c. from the Straw*, and for cutting straw; Abel Look, Pittsfield, Berkshire county, Massachusetts, June 13.

There is to be a revolving beater which is to act upon the grain, or other seed to be thrashed out. The supply is effected by means of a hopper, or of a revolving apron; the beaters operate against a hollow segment, supported on springs, having at its lower edge a rail, also supported on springs, and called a spring beater. When used to cut straw, knives are to be put in the place of the beaters upon the revolving shaft.

There is no claim, and as in the general structure there is no novelty, we are unable to discover for what the patent is taken.

---

36. For a *Mortising Machine;* Henry Marsh, Morristown, Morris county, New Jersey, June 13.

This mortising machine is stated to differ from those already in use in the following particulars.

In other machines the cutting apparatus works perpendicularly, in this *laterally* and *horizontally.*

In this the piece, if required, is mortised entirely through without turning it.

There is nothing used but the chisel, in making a mortise; it being unnecessary to bore a hole as is done with other machines.

Its work is more accurate, and performed with more despatch.

The combination of the respective parts to effect the object, is entirely new.

The claim made is to the general combination of the different parts as described and figured.

When a piece is to be mortised through, this is effected by two chisels, one on each side of the piece, worked alternately. The machine is clearly described, and distinctly represented, and appears to be well calculated to answer the end intended. Its particular ar-

rangements would require extensive engravings to make them intelligible.

---

37. For an improvement in the *Hill Side Plough;* Cyrus H. M'Cormick, Rochester, Rockbridge county, Virginia, June 13.

In this plough the different parts are so arranged as to effect the turning of the mould board, and certain other parts of the plough, and the securing them to the share when turned. The share remains stationary, being so made as to operate equally well both ways. The claim is to the mode of turning and fastening, and to the particular construction of the share.

---

38. For an improvement in *Rail-ways, and in Carriages for the same;* Alexander M'Grew, Cincinnati, Hamilton county, Ohio, June 13.

We see but little that is new, and much that is old, in this specification. The rails, we are told, are to be placed upon posts, so as to produce a plane, and the whole subject is treated as though the rails were every where to be considerably elevated above the ground. The carriage is to be kept upon the rails by the use of friction wheels, instead of by flanches, and are to work against a guard or projecting piece; they are fixed upon what are called guard arms. A strap, or brake, is placed between the wheels at each side of the carriage, and these straps are to be made to bear on each of the wheels at the same time, by means of a lever. To enable loaded wagons and carts to cross the rail-road, they are to ascend an inclined plane on to a revolving platform, which turns on a pivot in its centre, and on friction rollers much like those used both here and in England. When the rail-way cars are to be loaded, it may be done from these inclined planes. There are to be double tracks in proper places, for cars to pass each other.

The claim is to "the construction of the rail-way with a guard or projecting piece; the vertical friction wheels; the guard arms of the carriage; the turning out platforms; and the revolving platform for crossing roads, and loading the rail-way carriage."

---

39. For an efficacious method of *Destroying Plants, Insects, or other animals noxious to Planters,* and particularly the noxious plant known by the name of Coco amer, Grass Nut, Souchet amer, Ciperus Tuberosus Acris, Hydra, in the state of Louisiana; Joseph Nicolas, Interior Parish of Lafourche, county of Lafourche, Louisiana, June 13.

(See specification.)

---

40. For an improvement in the art of *Melting, or Making, Iron;* John Patterson, Warwick, Orange county, New York, June 13.

This patent is taken for an improvement in blast and cupola furnaces. The improvement consists in putting two blasts at the bottom of the furnace, in the usual way, and two others at every two feet above, until there are six or seven blasts. The furnace is to enlarge upwards; and is intended to burn coal of every species.

There is no drawing accompanying this specification.

---

41. For an improvement in the *Paddle Wheel;* Benjamin Philips, city of Philadelphia, June 13.

This is said to be an improvement in paddle wheels, and in canal boats to be propelled by them. A twin boat is to be made, allowing a space for the paddle wheels between the two parts. These two parts are to be connected together by iron bars, standing in the direction of the beams. These bars have screws cut on them, with nuts moved by levers, by means of which the two parts of the boat may be made to approach, or recede, thus varying the space between them according to the width of the canal or lock, through which the boat is to pass. The buckets of the paddle wheel are to be made to swivel upon the arms by which their centres are sustained, so that they may stand either athwart, or fore and aft. There is no account given of how this turning of the buckets is to be effected, or by what means they are to be secured in their positions.

The connecting the parts of the boat in the manner described, so as to vary its width, and the causing the buckets to turn and adapt themselves to the variation in width, constitute the claims.

We are not aware of the necessity for lessening the width of a boat in this way, as canals and their locks are always proportioned to each other, the latter being made of sufficient width to pass a boat which can pass another on the canal. There may be instances where canals different in dimensions may be connected with each other, in which case, the plan in question, if good in other particulars, would offer some advantage.

---

42. For an improvement in *Window Blinds*, denominated the retaining blind; Nathan Palmer, city of New York, June 13.

These blinds are so constructed that they may be retained in any desired position, and may be closed so as entirely to exclude the light.

Sliding pieces are let into grooves in the cheeks of the blind, and a rail at the bottom, which may be raised or lowered by a thumb screw, moves the sliding pieces up or down. One pin on the ends of the slots turns in the cheeks of the blinds, and another pin is connected with the sliding pieces, not directly, but by the intervention of a brace, or joint piece, one end of which is screwed to the blind, and the other to the slide, without which contrivance the slides could not work, excepting the grooves were made wide, as has sometimes been done.

In some instances the slots are connected at each end to circular pieces, or wheels, which are let into the cheeks, and these wheels

are made to revolve, and close or open the blinds, by means of the slides.

The claims are to the retaining the slots in any desired position, and to the two methods described, by which the blinds may be mounted; with such variations as may be made in attaining the same end.

---

43. For a mode of *Reducing Friction in Wheel Carriages*, and all kinds of machinery; John Joseph Reekers, city of Baltimore, June 18.

The claim in this patent is to the reducing friction by means of the apparatus which it describes, consisting, mainly, of a hollow cylinder, rings, and rollers, or, in other words, of Garnett's friction rollers, which have been represented in nearly every elementary work on natural philosophy and mechanics, published within the last forty years. In most of the instances, and there are many, in which this apparatus has been patented over again, some variation of the original plan has been proposed, under the garb of an improvement; but in the present instance we have the genuine old fashion friction rollers in their original dress.

---

44. For a *Soda Fountain;* Alonzo S. Smith, Brutus, Cayuga county, New York, June 13.

We have already twice described this invention as the subject of a patent, once at page 176, and again in our last number, page 249. The present patent, and that noticed at p. 249, are of the same date, and were, certainly, interfering applications.

There is, in fact, no essential difference between the three, excepting that in the two former, tartaric acid and carbonate of soda were alone to be kept in solution in separate vessels, whilst in the present case we have the additional information that rum, brandy, gin, cider, meed, bear, &c. &c. may be drawn altogether, or any number of them, as may be desired.

The claim is to the double or many source fount, as applied to the purposes described.

---

45. For an improvement in the art of *Raising Water* by means of what is called the labour saving pump; Daniel Smith, China, Genessee county, New York, June 13.

This is merely a double lifting or forcing pump, such as is well known, and in established use. There are to be two barrels, pistons, and rods, worked by one lever without addition or variation from the old pump. If well made, therefore, experience tells us that it will work well, but not that it will save labour more effectually than its prototypes.

---

46. For *Sizing Hat Felts, and Napping Hat Bodies, by*

Steam; David Sutton, Lancaster, Gerrard county, Kentucky, June 13.

A hexagonal, or octagonal box is to be made to revolve, like a barrel churn, by turning a crank. Through one of its gudgeons steam is to be admitted from a steam boiler. When hat felts are to be reduced in size to prepare them for napping, they are to be put into the vessel mentioned, in a wet state; steam is then to be admitted, and when heated, the vessel is made to revolve until the intended effect is produced.

When bodies are to be napped, after *sticking* the napping on, they are to be put into the same vessel in a dry state, the steam admitted, and the machine turned by means of the crank, for twenty or thirty minutes, or until the process is completed. The claim is to these two processes.

---

47. For a machine for *Planing, Edging and Grooving Boards;* Jacob Tees, Kensington, Philadelphia county, Pennsylvania, June 13.

A bench is prepared to sustain the planes, and other apparatus required for the operation. The planes are to be stationary, and the board is to be forced against them. For this purpose the board is made to pass between friction rollers, turned by drums and straps. The first plane is to plane the surface. In its stock there are to be seven, or more, irons, all of the full width of the board to be planed. After passing this, it arrives between two other planes, similarly provided with irons, for planing its edges. Behind these it comes in contact with a pair of match planes, each with seven, or more, irons, to tongue and groove the board, which is thus finished. To reduce the board to a width, it is proposed to place a circular saw at the entering end of the bench, which saw is to be turned by the same power which gives motion to the plank.

The description of the operation of this machine goes on as smoothly as the proposition of Falstaff to kill the enemy by fifties, and we err greatly in our calculations should the machine eventually prove more successful than the *hero.* Thirty-five plane irons, at least, and seven of them six inches wide, all acting together, will present obstacles to the motion of a yellow pine board, which the friction rollers will scarcely overcome, and if they do, they must operate as flatting mill rollers, and condense the stuff. We see many other, and formidable, objections, to this machine, which we have not space or time to present to our readers.

We are also at a loss to know how the circular saw and the planes are to work upon the same plank at the same time: what is to become of the strip?

When this machine goes into successful operation, we shall be glad to hear of it; we will then cry *peccavi,* and cheerfully *send in our adhesion.*

---

48. For a *Horse Power Engine,* to be used for propelling ma-

chinery of all kinds; Isaac Van Doren, Hopewell, Huntingdon county, New Jersey, June 13.

This horse power engine is not a horse power steam engine, but is one intended to evade the laws of nature by causing the power of one horse to produce an effect equal to that of five. It is consequently to be "a cheap and efficacious substitute for steam and water power."

A horse is to turn a shaft by means of a lever, this lever carries an endless screw which acts upon a toothed wheel. Upon the shaft of this wheel, is a large spur wheel, which takes into a pinion, giving motion to a drum, a strap from which is to drive the machinery.

The inventor has, probably, not seen the necessary result of his invention, or he would have carried it still further. If the drum at the end of the train moves with the power of five horses, let him employ this to drive another *horse power machine,* and the next drum will have the power of twenty-five horses; and so on *ad infinitum.*

---

49. For a *Machine for Washing, Pressing, Ironing, Crimping, and Drying Clothes, &c.;* John Newhall, Dayton, Montgomery county, Ohio, June 13.

This, which may certainly be called the *washerwoman's assistant,* consists of separate machines, most of which are, in form and substance, like such as have been before used. The clothes are to be washed by being put into a dash wheel, turned like a barrel churn, having numerous holes bored through it, and turning by a crank, in a vessel containing soap suds. About thirty revolutions, we are told, will wash the clothes, but we are hard of belief. When very dirty, round wooden balls are to be put in with the clothes, as has often been done. The clothes, when washed, are to be put under a screw press instead of being wrung. They are to be dried by means of a large vessel of copper into which steam is to be admitted, and the clothes spread upon it. The ironing is to be effected by "a mangle and crimper improved *on the European mode,* by the additions of another roller and crimper. These are the main points of the system, to which no claim is made either in whole or in part; we are left, therefore, if we can, to consider the whole as new.

---

50. For a *Weighing Machine;* Thaddeus Fairbanks, and Erastus Fairbanks, St. Johnsbury, Caledonia county, Vermont, June 13.

This is a machine intended for weighing loaded wagons and carts. The vehicle to be weighed is driven on to a platform, which is suspended upon proper fulcrums and levers, and these are to act upon a steelyard, by which the weight may be ascertained with considerable accuracy. Such machines are common on turnpike roads, and at coal yards; and the machine now patented is a mere variation of the general principle upon which these are made, without presenting

any thing which can be fairly called an improvement. The patentee has described the whole machine without claiming any part.

---

51. For machinery for *Moulding and Docking Crackers*, sea biscuit, cakes, &c., and for making wafers; Jonas P. Fairlamb and Miller Dunott, Wilmington, Newcastle county, Delaware, June 13.

The dough from which crackers, &c. are to be made is passed between rollers which deliver it of the proper thickness; it then passes between another pair of rollers, one of which has a smooth surface, and upon the periphery of the other is placed a row of moulds which cut the crackers; from these moulds they are made to fall regularly upon an endless apron. The cylinders are hollow, and within that furnished with moulds, a smaller cylinder revolves, which acts upon the heads of followers or pistons, contained in each mould, and forces the cracker out. Another modification of the machine is described, but it operates upon the same principle.

The claim is to moulding and docking by cylindrical pressure.

---

52. For a *Paste, or Composition, to be used in Sharpening Edge Tools*, and for grinding and polishing metals generally; Peleg Barlow, America, Dutchess county, New York, June 13.

This paste, or composition, is to be formed of a mixture of white and red lead with linseed oil and emery, or with red lead, oil, and emery, which is to be spread upon wood, and to form rifles for sharpening scythes, &c.

The resemblance between this patent and one obtained in March last is so great, that we are not aware of the object of the patentee in obtaining a new one, excepting it is merely to vary the proportions of the ingredients.—See page 8, of the present volume.

---

53. For a *Thrashing Machine;* Isaac Van Doren, Hopewell, Huntingdon county, New Jersey, June 13.

In this machine there are two revolving cylinders between which the material to be thrashed is made to pass. Upon one of these cylinders there are springs, or vibrating beaters, and upon the other stationary beaters. The general arrangement of this machine is considered by the patentee to be different from any other extant, it having, he thinks, nothing in common with them but those accessory parts without which such a machine cannot exist: his claims are made accordingly.

---

54. For a mode of *Spinning on Throstle Frames*, called the Bobbin regulator, John Brown, of Providence, and John Sandish, of Cranston, Providence county, Rhode Island, June 13.

For the washer cloths generally used, the patentee proposes to substitute a small whirl, which is to be placed under the bobbin,

and this, with the aid of friction bands, is to regulate the draft upon the thread. The plan appears to be good, and new, but without a drawing the mode of using this whirl and its appendages cannot be clearly explained.

---

55. For an improvement in the steam engine, called the "*Steam Lever Rotary;*" John Catlin and Calvin Fletcher, Cincinnati, Ohio, June 13.

Steam is to be admitted into a steam pipe, which is bent round so as to form a hollow ring. Within this ring is a wheel the surface of which is formed into steps or vanes, and from the hollow ring several pipes conduct steam on to the surface of this wheel, discharging it tangentially, and consequently blowing the wheel round.

The patentees claim the discharge of steam directly upon the surface of a wheel, thus avoiding all necessity for packing.

This is certainly a primitive steam engine, being in principle as ancient as the days of Hero of Greece. It will, undoubtedly, blow the wheel round with great velocity, but where economy is to be considered, and power in proportion for the outlay for fuel is required, this machine will not establish itself.

---

56. For applying the power of a pendulum clock to a *Swinging Cradle;* John M'Kenney, Chester, Butler county, Ohio, June 13.

The cradle is to be the bob of a pendulum, there being a wire rod at each end by which it is to be suspended. The proper wheel work, escapement, and weights, are supported by suitable frame work, the whole of which assumes a very formidable appearance, when the object in view is considered. The claim made is to the application of the power of the pendulum clock, to the rocking of a cradle.

A former patent for rocking a cradle by clock work, upon similar principles, received due attention, (see vol. v. p. 126,) and we think it unnecessary to indite any thing new upon the subject.

---

57. For a *Churn;* Samuel Sweet, Readfield, Kennebeck county, Maine, June 13.

This churn is spoken of in the specification as being one of a very superior order, yet it is so similar to many other churns, that its appearance would not have secured the preference to which it lays claim. It consists of a box in which a shaft is made to revolve horizontally. This shaft carries two wide dashers, which agitate the cream. The bottom of the box is made circular, and the sides straight. The claim is to this circular bottom and the straight sides; to the horizontal shaft, the wide ladle boards, and several other things, among which are the "turning with a hand crank; also the cheapness and convenience of the work."

58. For a *Washing Machine;* James Appleton, Richmond, Virginia, June 13.

This is a swinging machine, with polygonal sides; the inside of the swinging box is furnished with rollers, secured at each end, which are to aid in cleansing the clothes when the rocking motion is given by a lever.

---

59. For an improvement in the *Winnowing Mill;* Moses Elliot, Boscawen, Merrimack county, New Hampshire, June 13.

This fanning machine differs considerably in the arrangement of its parts from those in common use, which difference is summed up in a clear manner in the claim of the patentee, of which an abstract must suffice.

The fans move horizontally in a drum, reducing the height of the machine to about three feet.

The channel for the passage of grain is narrowed, which gives more force to the wind, and cleans the grain more effectually.

The length of the mill is reduced by the position of the box and hopper, which are placed over the fan.

A more simple combination is given to the parts generally.

---

60. For an improvement in the *Machine for Cutting Crackers,* &c. (patented on the 13th of September, 1830,) by Jos. Clark and Henry Henderson, city of Baltimore, June 13.

The parts of the machine as described in the first specification all remain unchanged, with the exception of the sliding board to receive the crackers after they are cut; for this, an endless apron, revolving upon rollers, is substituted, and upon this the dough is made to pass from the cylinders by which it is rolled out. The cutting is effected upon this revolving apron. The claim is to the use of the apron upon which the crackers are cut, and by which they are carried off. It will be seen that in a patent of the same date, No. 51, a revolving apron is used to carry off the crackers from a machine in which they are cut upon revolving cylinders.

---

61. For an improvement in *Piano Fortes;* Thomas Kearsing, Henry O. Kearsing, George T. Kearsing, and William F. Kearsing, city of New York, June 13.

The principal improvements here claimed consist in a different arrangement of some parts of the English action from that heretofore pursued. These cannot be described without a drawing. The mode of hanging the wire on the hitch pins, is also new, and claimed by the patentees. Instead of the usual mode of forming an eye, or loop, by doubling the wire and twisting the two parts together, three or more turns are made by the wire round the hitch pin, and the short end is then to be turned several times round that part of the wire which is to be strained, which mode of procedure, it is said, prevents the crippling of the wire.

Specifications of American Patents.

Specification of a patent for an improved mode of constructing the Standing Press, for pressing paper, tobacco, or other articles, requiring to be pressed. Granted to Charles Evans, *city of Philadelphia, June* 13, 1831.

The bottom, or bed, and the top piece, which also answers as a platten, or follower, I usually make of cast iron, although, for certain purposes, wood, or other suitable material, may be employed. Instead of cheeks, two screws, of such length and thickness as may be required, rise vertically from the bed, one standing near each of its ends. A metal box, or nut, is adapted to each of these screws, and these nuts are firmly fixed in the centres of cog wheels. These wheels are of such diameter that when the boxes are in their places, the peripheries of the wheels will approach each other within the distance necessary to allow of an endless screw to pass between them. The cogs of the wheels are cut, or made, bevelling, so as to adapt them to the threads of such a screw.

The platten, or follower, is placed below the two cog wheels, so as to raise and lower with them. The lower ends of the boxes, or nuts, are attached to the upper side of the followers, and are to swivel in or on it. Upon the upper side of the platten, an endless screw turns in collars, its threads taking into those of the cog wheels. At the outer end of its shank, there is a crank, or handle, for the purpose of turning it.

The screws which occupy the places of cheeks in the ordinary press, must have their threads cut in a direction contrary to each other; that is, one of them must be a right, and the other a left, handed screw; as the endless screw will turn the cog wheels in opposite directions.

A press, operating in a way somewhat similar, may be made with the side screws both right or left handed, but in this case two endless screws must be cut on the same spindle, and so placed that one of the screws may act upon the periphery of one wheel, and the other on the periphery of the opposite wheel. This spindle must extend along the front or back of the press.

What I claim as my invention, and for which I ask a patent, is the application of screws instead of cheeks to the sides of the standing press, so connected that the raising or lowering of the platten or follower must be effected by means of cog wheels, and an endless screw or screws, operating upon the principles herein described.

Charles Evans.

Specification of a patent for an improvement upon, or addition to, a combination of liquids to be used as a substitute for oil in the production of light; for which a patent was granted on the 16*th day of October*, 1831. Isaiah Jennings, *city of New York, June* 13, 1831.

I take the spirit, or essential oil, distilled from tar, or any of the vegetable essential oils, or the spirit of coal tar, which is a species of naphtha, or that obtained from the Seneca oil, or other bitumens, by distillation, and combine them with alcohol, or spirits of wine, as I have heretofore combined the essential oil, or spirits of turpentine, therewith. This I do in such proportions as may be found expedient, according to the nature and purity of the articles employed. When the alcohol is highly rectified, it will combine with a larger portion of the other ingredients, than that which is of lower proof. The general rule is to add to the alcohol as much of the other ingredient as can be taken into combination with it, which may vary from one-fourth to one-eighth part, the quantity of alcohol always greatly predominating.

The combination of liquids thus produced, I use as a substitute for oil, to burn in lamps of any description in which oil may be burnt.

What I claim as my invention, or improvement, is the combining of the articles above specified, with alcohol, in the manner, and upon the principles hereinbefore set forth, for the purpose of burning the same as a substitute for oil in lamps.

Isaiah Jennings.

Specification of a patent for a mode of preparing Alcohol, or Ardent Spirit, from Grain, or other vegetable substances capable of undergoing the vinous fermentation, and of employing the residuum more advantageously than has been hitherto done. Granted to Isaiah Jennings, *city of New York, June* 13, 1831.

I take the grain, meal, flour, or other vegetable matter to be fermented, and I add to it a quantity of water sufficient to give it a consistence about equal to that of homminy, or paste, and in this state I add to it yest, or other ferment, and allow the vinous fermentation to take place; as soon as this is completed, and before acidity commences, I place the material so fermented in proper distilling vessels, and submit it to the proper degree of heat, by means of steam, heated air, or any other agent the temperature of which can be governed so as to prevent all danger of burning, and I then draw off all the spirit from it. After this has been effected, I continue the heating process until I render the vegetable substance as completely dry as though it had been kiln dried. This substance is then fit to be stored away, or ground into meal, and bolted, so as to be employed as food for man, or other animals. Wheat, or other grain,

which has been submitted to this process will make perfectly sweet bread, and will rise without requiring yest, or other ferment.

What I claim as new in the above process, is the fermenting of the vegetable materials with no more water than is necessary to give them the consistence designated, and afterwards employing the dried residuum for the purposes hereinbefore set forth.

ISAIAH JENNINGS.

Specification of a patent for a new method of Washing Rags in the manufacturing of Paper. Granted to DAVID AMES, *Jr. and* JOHN AMES, *Springfield, Hampden county, Massachusetts. Assignees of Samuel Eckstein, Philadelphia, June* 13, 1831.

INSTEAD of the washer, or screw, now in use, I employ a circular disk or plate, which is covered with wove wire, and is made to revolve within the cistern, or vat, of the paper engine, against the side opposite to that on which the cylinder, or roll, is placed. The revolution of the circular disk is effected by means of a pinion upon the shaft of the engine, which pinion mashes into a cog wheel placed upon the same shaft upon which the disk, or plate, is fixed, and with which it revolves.

A brass ring, which may be one foot in diameter, and one inch in thickness, is fastened by bolts, or screwed, on the inside of the cistern, concentric with the shaft upon which the disk, or plate, revolves. This shaft carries, upon its inner end, a brass wheel, which may be twenty-two inches in diameter, more or less. The face of this wheel, towards the inside of the engine, receives the covering of wove wire. It has on the back of it a secondary or smaller rim, of such a size as to fit against the fixed ring, first mentioned, and forming a joint with it. A rim of wood is screwed on to the face of the larger brass wheel, to which to attach the facing of wove wire through which the water is to run from the vat. Below the fixed ring, a space six inches wide, and an inch deep, is cut out of the side of the engine, and through to the bottom; this space, when covered with a sheet of copper, forms a vent for the water which passes from the engine through the wove wire into the space formed by the projection of the fixed ring. Through this wire disk, and these openings, the water finds a free exit, without obstructing the motion of, or wasting, the pulp. A larger quantity of water, therefore, may be admitted into the vat, than is ordinarily done; and the washing is more rapidly, effectually, and economically performed, than by any other means now in use.

What I claim as my invention, is the revolving disk, or plate, covered with wove wire, and so placed within the vat of a paper engine as to allow the water to pass freely through it, upon the principle, and for the purposes herein described.

SAMUEL ECKSTEIN.

It will be seen that the effect produced by the invention of Mr. Eckstein is similar to that of Mr. Ames, the specification of which

may be found at page 127. To prevent all interference the Messrs. Ames became the purchasers of the improvement above described.

Specification of a patent for a new method of destroying noxious plants, insects, or other animals, and particularly the noxious plants known by the names of Coco Amer, Grass Nut, Souchet Amer, Ciperus Tuberosus Acris, Hydra. Granted to Joseph Nicolas, *Interior Parish of Lafourche, county of Lafourche, Louisiana, June* 13, 1831.

It consists, 1st, in ploughing the field infested with the above noxious plants, insects, or other animals, to the depth of eight or ten inches, more or less, according to the soil. 2nd. In a carriage moved by steam, or other power, upon which a steam boiler is fixed; to which boiler are adapted a force pump moved by steam or otherwise, to convey water in the boilers, and one or several pipes to convey the steam from the boiler to any desired portion of the surface ploughed. The heat of the steam instantaneously effects the destruction intended.

If the first aspersion, or sprinkling, be not sufficient for obtaining the desired effect, (which is very seldom the case,) the ploughing and sprinkling of steam must be repeated.

Jos. Nicolas.

ENGLISH PATENTS.

To James Down, *Surgeon, for his having invented certain improvements in making Gas for illumination, and in the apparatus for the same. Sealed 5th August,* 1830.

This invention consists, first, in making or generating gas for the purposes of illumination, out of certain portions of the residuum, which, in the ordinary mode of conducting the process, is not available for those purposes—by passing crude or nascent gas, with its vapour of tar and ammonia, through a long stratum of ignited charcoal or coke, and thereby evolving an additional quantity of gas from the impurities of the said nascent gas; and, secondly, in an improved box or vessel, contrived to contain a *long* stratum of charcoal or coke, in a state of ignition, in a *small* compass.

The impure gases produced by the usual modes of distillation from pit coal, or any other substance from which gas can be procured in the ordinary way, is to be passed through an extended stratum of ignited charcoal or coke, by means of the improved apparatus: which consists of a box or vessel of iron, or such other substance as will withstand the action of heat, the box being furnished with divisions, and nearly filled with charcoal or coke.

This box or vessel may be connected with the ordinary retorts,

and by this means the necessary purity will be obtained by the very process of generating it from the impurities of the nascent gas, without any special apparatus for that purpose.

In the common mode of making gas fit for illumination, as generally practiced; the gas is passed through a variety of processes and apparatus to effect the different progressive degrees of purification required, while the residuum, containing much good gas, is not converted into that material. In this improved mode of making or generating gas for illumination, the gas in its crude and nascent state, with the tar and its vapour, the ammoniacal liquor and its vapour, and also the sulphureous gas, is passed at once into the said box or vessel, constructed and filled as aforesaid, and thereby sufficiently purified, while it is evident that the external shape, general form, and dimensions of the box or vessel may be arranged and adapted to its situation, so as best to suit the circumstances of the particular establishment where the gas is to be generated and used.

The before described improved box, vessel, or apparatus, with its passages, must be filled, as before stated, with charcoal or coke, and heated to a degree of temperature sufficient to cause the enclosed charcoal or coke to be in a constant state of ignition; the heat necessary to be applied to this box, vessel, or apparatus, must be limited to that of a good gas making heat, for if it should be urged to a higher temperature than this, it will be injurious to the box, or vessel, and at the same time detrimental to the illuminating power of the gas.

The heating of this improved box, vessel, or apparatus, may be accomplished by setting it in the same furnace, or bed, with the retorts, and connecting two or more retorts with it; or the like effect may be produced by embedding it in a distinct and separate furnace, but the method before described is preferred. It is only necessary further to state, that when it is required to remove the charcoal or coke from the above described improved box, or vessel, for the purpose of replacing fresh materials therein, it may be done by displacing the mouth-piece or top parts of the box, or vessel; and it will be obvious that whatever sized box may be resorted to, it must be so contrived and placed, that its contents may be capable of being removed at the pleasure of the operator.

The patentee says, "I claim as my invention, first, making or generating gas, for the purposes of illumination, by passing crude or nascent gas through a long stratum of ignited charcoal or coke, whereby I evolve an additional quantity of gas from certain portions of the residuum, which, in the modes hitherto adopted, are useless for those purposes; and whereby I do away with the necessity of a separate purifying apparatus. And, secondly, the improved box, or vessel, contrived to obtain that object, by means of the extended stratum of charcoal or coke, hereinbefore described."

To Thomas Bulkeley *Doctor of Physic, for his invention of a method of making or manufacturing candles. Sealed 26th January,* 1830.

These improvements in making candles consist in three particulars:—first, in making wax candles in moulds, instead of forming them by rolling the wax, which is stated to be the ordinary way of producing wax candles; secondly, in making a case of wax shaped like a candle, which is to be afterwards filled with tallow or oil, or other combustible material suitable for making candles; and, thirdly, in forming and adapting a sliding wick for a candle, which shall descend as the candle becomes consumed, and never require snuffing.

The first object requires but little further explanation. To cast wax candles in moulds, it is obvious that the wax must be poured into the moulds in a hot and liquid state, and when perfectly cold, the end of the candle is to be struck with a small wooden mallet for the purpose of disengaging it from adhesion to the surface of that mould, when it may be withdrawn. The patentee has not said in what particular these mould cast wax candles will be superior or preferable to those made by rolling the wax in the ordinary way.

In putting the second feature of the invention into operation, it is proposed to pour into the candle moulds the melted wax, as in the previously described process of moulding; and on the wax having cooled and become partially set or hardened, which it will do round the internal surfaces of the moulds before the wax in the central part of the candle has become set, then to pour out of the mould the liquid portion of the wax which filled the central part of the candle, and allow the shell of wax thus formed on the surface of the mould to become hard. This shell may then be made the mould in which melted tallow, or cocoa nut, or other oil, may be poured, and a wick introduced for the purpose of making a candle resemble externally a wax candle; and as the wax will not melt at the same temperature as tallow, the candle will not be subject to guttering down, but the tallow or oil will always burn below the surface of the outer case of wax, which will gradually melt down by the heat of the flame, and have the same transparent appearance as a wax candle.

Lastly, the improved wicks, which are to be adapted to candles, are to be formed by extending a thin string of flax through the candle, and placing upon this string at the upper end a small tube of straw or paper, which tube will be sufficient to collect the fluid tallow, or other material, by capillary attraction, and so to form a wick or receptacle for the combustion of the tallow, and its conversion into the gas that supports the flame of the candle; and as the tallow becomes consumed, the wick will gradually descend, guided by the string still constituting the wick, while the string will moulder away as the candle becomes consumed, and not require snuffing.

To Robert Stein, *Gentleman, for his invention of an improvement in applying heat to the purposes of Distillation. Sealed* 13*th December*, 1827.

The object of the patentee appears to be to economise fuel in the process of distillation, and for this purpose he proposes to connect a series of stills, and to conduct the heated vapour evolved from one still into or under the next still in the connected range, for the purpose of heating the wash contained in the second still, and causing it to throw off its spirituous vapour, which in like manner is to be conducted to a third still, for the purpose of heating it, and so on.

No precise construction of apparatus is claimed, but it is proposed as eligible to attach a sort of jacket or casing to the lower part of each of the connected stills, and to carry a pipe from the head of one still to the under part of the next, through which pipe the vapour passes, and coming in contact with the bottom of the wash vessel of the next still, heats the liquor therein sufficiently to drive off its spirituous vapour, as in the ordinary process of distillation, which vapour is carried forward from the head by a pipe, to the under part of the succeeding still, and so on to the last still of the range, from whence the vapour there evolved passes to the worm tub; and the vapours which have thus operated, and have given off their caloric, and become condensed into liquids in the vessels under the several stills, are drawn off from those vessels for rectification.

The patentee does not confine himself to the above described apparatus, but sometimes carries the vapour by a pipe, from the head of the first still, down into the wash of the next still, where it oommunicates its caloric to the wash, and so prevents the useless dissipation of the heat.

The stills being arranged and connected in any convenient way, are to be furnished with all the necessary pipes and cocks for conducting the wash, and for drawing off the product; but these form no part of the invention, which the patentee says, "consists in applying some portions of the heat used for distillation over and over again."

Remarks on Wheels for Locomotive Engines, with a description of the Coal Wagons employed on the Liverpool and Manchester Rail-way.

From Wood's Treatise on Rail-roads, new edition.

It has been urged against case-hardened wheels, that their hardness makes them liable to cut the rails: this might apply to narrow rubbing surfaces, but cannot have any application to one surface rolling over another, when the hard surface is the rolling one, and also the broader. I have often examined, very carefully, their action upon the rails, but could never find any tendency in them to cut the rails; when the common wheels are indented on the surface of the rim, they are very liable to injure the rails, from the periphery thus grooved breaking the sides of the bearing surface of the wheels

off, and leaving only the middle section. This is frequently the case, as may be seen on all those rail-roads upon which the common wheels have been long used. The universal adoption of case-hardened wheels on all the principal rail-roads, in preference to the common wheels, is, however, the best criterion which can be adduced of the general belief of their superiority. The case-hardening is, as previously explained, effected by running the metal against a cold cylinder of cast iron. I am inclined to think, that this tends to form the wheel more perfectly cylindrical than casting in the ordinary way: which will lessen the resistance by remedying any resistance arising from the undulatory motion produced by the imperfect circular form of the rim.

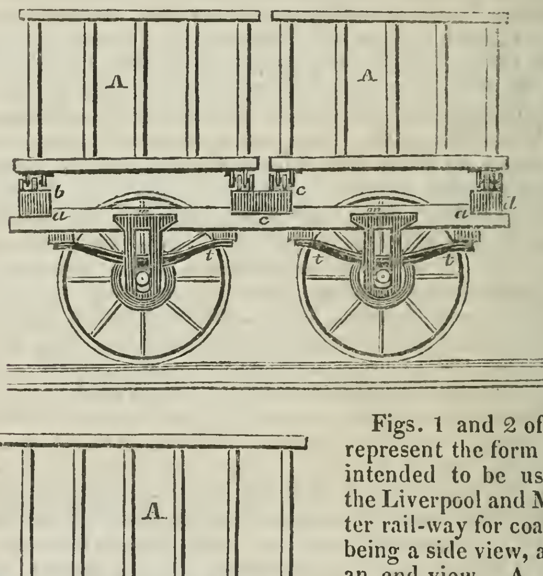
The very great rapidity at which it is now proposed to travel upon some of the public rail-ways, renders the liability of case-hardened wheels to break;—not only from the brittle nature of the material, but also by the friction of the wheels upon the rails at such great velocities, heating and expanding the rims—an object of very serious consideration; various plans have already been devised to obviate this objection. It will be subsequently seen that the cast iron wheels of the Killingworth engines had been hooped with wrought iron tires, which was not only found to be quite practicable, but also a great saving in the wear, compared with common cast iron wheels; since that time, the wheels of the engines made by Messrs. Stephenson & Co. have been either made of cast iron, hooped with wrought, or with wooden spokes, on which was laid a malleable iron tire: wheels thus hooped, though more expensive, seem quite necessary for the rapid rate at which some of those engines are propelled. The same plan of hooping the cast iron with wrought iron tires, has also been adopted with respect to the common carriages, which, like the engine wheels, though more expensive, is strictly necessary.

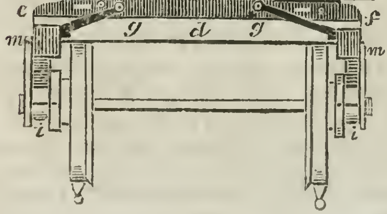
Messrs. Jones, of London, have a patent, which is described in the sixth volume of the "Repertory of Patents," p. 279, Third Series, where the spokes are screwed into the nave, and thereby any strain by the unequal expansion of the rim is obviated.

The axles of the carriages used at the coal works are universally made of wrought iron, being square at the ends, to fit the square hole *d*, through the nave of the wheel. Upon the frame of the carriage is fixed a chair, which rests upon the axle, the latter being turned smooth, to reduce the friction as much as possible. Upon the side of this chair a projection is cast, extending beyond the side of the frame of the carriage, which projection, by rubbing against the faced flanch *f*, in the nave of the wheel, prevents the carriage from coming in contact with it; and, being kept well greased or oiled, reduces the friction, when, by one side of the road being lower than the other, the body of the carriage is thrown to one side; or this is sometimes effected by putting a loose ring upon the axle, which rubs against the flanch *f*; the latter I consider more preferable, as rubbing nearer the centre of motion, and more likely to keep lucubrated with oil. These chairs have successively been made of wrought iron, brass, and cast iron; the latter I consider the most eligible, for reasons which I shall hereafter assign. The size of the axles will necessarily depend upon the diameter of the wheels, and the weight they have to sustain.

Upon the wagons used to carry the coals from the collieries in the neighbourhood of Newcastle, the diameter of the axles is from two inches and a half to two and three-quarters, and the diameter of the wheels about three feet; the weight of the carriage and load amounting to above three tons.

Upon public lines of road, the form of the carriages will, as before stated, vary with the nature of the goods they are required to convey; bulky goods of course requiring larger carriages. The drawing of the carriages previously given, is for the conveyance of coals; in these, the sides of the carriage come between the wheels, and the upper part projects in the form of a hopper: this plan for coal wagons is very convenient, where, as in the north, the coals are to be emptied out at the bottom, at the shipping places. For the conveyance of coals into towns a different form is necessary, as in this case, the carriage used for the rail-way must either be so constructed as to travel upon common roads, or the body of the carriage must be of such a form that it can be transferred to wheels suitable for the streets.





Figs. 1 and 2 of the cut represent the form of those intended to be used upon the Liverpool and Manchester rail-way for coals; fig. 1 being a side view, and fig. 2 an end view. A A is the body of the carriage, which is a square box, capable of containing about 25 cwt. of coals. Upon the frame *a a* of the carriage are fixed the cross sills *b c d*, fig. 1, and *d* fig. 2; on these, angular plates of iron rest, forming short pieces of plate rail-

way along the cross framing. An end view of these plates is shown in fig. 1; and *e f*, fig. 2, is a side view of the plate resting on the sill *d*. On the under side of the framing of each of the boxes, four small vertical sheeves are fixed, which support the boxes, and which run upon the plate rails, shown also at *n o*, fig. 2. To prevent the boxes from rubbing against the sides of the plate, small horizontal sheeves are fixed to the same frame work, shown at *r s*, fig. 2, which run against the upright edge of the plate. The body of the carriage can thus be moved readily back and forward along the plate rail. To prevent the boxes from moving, and to keep them steady upon the frame while the carriages are travelling, two catches, *g g*, are made use of, working upon a joint at one end, and resting upon the end of the frame work of the carriage, on the other. Carts, drawn by one horse, are used to convey one of those boxes from the rail-way through the streets. Plate rails, similar to those upon the rail-way carriage are fixed upon the frame work of the cart, so that when the cart is backed against the side of the rail-way carriage, with the plate rails of both forming a line, the boxes are easily run from off the rail-way carriage upon the frame of the cart; the empty ones being similarly transferred from the cart to the rail-way carriage.

Although the drawing shows only the form of boxes used for the conveyance of coals, yet it will readily occur that the form can be varied to suit the carriage of any kind of articles; the frame work, or body of the carriage being raised above the wheels, the breadth can be extended to any width which the distance between the rail-way will admit.

The body of the carriage is supported upon springs resting on the middle of the chairs of the axles; and the axles being projected beyond the sides of the frame work, the diameter at the bearing is consequently diminished; *t t*, *t t* are the springs resting on the chairs *i i*; the other end working upon plates of iron fixed to the frame of the carriage. *m m* are the guides that the chair works between, the extreme ends of which form a sort of cap projecting beyond the guides. The chair has a cover on the under side, to prevent the waste of oil, being screwed tight to the upper part, with a leather washer between. The oil is fed into the top of the chair, by a syphon wick, inclosed within a tin box, which holds a sufficient quantity of oil for supplying the axle for several hours; and by means of the syphon the oil is continually feeding upon the axle.

Observations on a new mode of constructing Harbours. *By* William Matheson, *Civil Engineer. Communicated by the author.**

The importance of good harbours to a mercantile country will be universally admitted, and the commercial eminence Great Britain has attained, has naturally directed the attention of persons interested in the extension of her trade, to the improvement of the sur-

* Read before the Royal Society of Edinburgh, 1831.

rounding harbours; and, perhaps, in no way have the skill and ingenuity of engineers been more extensively employed, or more usefully directed. Many great works have been executed at an enormous expense, and some of them have succeeded more or less, to the expectation of the parties.

The erection of works within tide-mark must always be attended with trouble and additional expense, and it is the more to be lamented after such extensive operations have been carried into effect, that the whole benefit of them should be frustrated by some unforeseen circumstance, which has too frequently happened in such operations.

Of these latent difficulties, none has had a more powerful influence than the tendency of the tide, or the motion of the water in particular situations, to silt or sand up spaces which have been enclosed, and upon which, by means of such enclosures, a change has been made upon the currents.

This tendency to sand up is peculiar to every situation where quantities of sand are under the influence of the tide, or the motion of the waters, and liable to be carried from place to place in mechanical combination with the water, either by means of the ebbing and flowing of the tide, or of the motion given to it by particular currents; or, by, what is the most powerful of all, the motion given to it by the violence of the winds.

This motion of sand is generally in a direction opposite to that in which the wind is blowing, as may be seen in standing pools or lakes, where the sand, when the water is agitated by the wind, takes shelter under the banks of the weather side; but this will be more particularly explained afterwards.

In consequence of this tendency, the mouths of all rivers, and flat shores, and all bays and estuaries into which the tide rushes with violence, are more or less subject to the accumulation and shifting of sand banks, if sand is to be found in such situations. Examples of this may be seen by examining the harbours of Aberdeen, Dundee, Dublin, and a variety of others; and it may be generally asserted, that no harbour was ever erected upon a river, that was not more or less subject to the inconvenience of shifting sand banks at the mouth of the river, or of being itself sanded up.

The writer of these observations having been employed at an early period of life, in works connected with harbours, his attention was particularly directed, more than thirty years ago, to the annoyance met with by the sanding up of harbours; and he saw the object frustrated, after the most expensive works had been erected, in the hope that they would answer every purpose expected from them.

Never loosing sight of the evil which he had observed, nor ever ceasing to feel a desire to have it removed, he at last, by mere accident, discovered in the harbour of Pulteney Town, a circumstance which led him to a corrective theory upon the subject.

An opening had been left in the inner pier for upwards of a year, while the other operations of building were going on, and through which opening the receding tide, assisted by the land stream, passed into the harbour, and swept round, and again passed out at its mouth.

By this action of the tide, the harbour was kept perfectly free from any tendency to sand up; but in the course of a very short period, after the works were finished, and this opening closed up, in completing the harbour, the sand accumulated in it to such a degree as to make it inaccessible to vessels of even very small tonnage, and to cause the outlay of a large sum of money in the erection of an outer harbour which it is probable will be visited with the like obstructions, if they have not already taken place.

The practical hint thus afforded, induced the writer to form the idea of erecting the necessary works for sea harbours, with artificial openings, so constructed as to enable the waters still to retain their natural motion, and by that means to avoid eddies and stagnation, by the latter of which the sand and alluvion are deposited, and by the former of which the deposition is shifted and whirled from place to place.

His plan, therefore, may be very shortly described. Wherever it may be necessary to erect a harbour, or to extend the works of one in a situation where sand or alluvion may be likely to accumulate, he proposes, after laying a solid foundation of stone, to make the next range of buildings consist of a succession of arches of such a height of opening as not to disturb any class of vessels that may frequent the harbour, while they are protected and sheltered by the solid buildings erected over these arches, and at the same time, the openings shall be so proportioned to the depth of water, at the different points of the building, as to allow the tide to pass freely through.

To enter into any detail as to the particular mode of constructing the work, or of forming the arches, &c. is quite unnecessary here, as these must vary according to circumstances. It is enough, if it be admitted that walls with arches may be constructed under water, as well as solid walls: because so much being granted, it will appear sufficiently obvious that the motion of the tide, either in approaching or receding, will naturally pass through these arches, and carry with it both in advancing and retiring, whatever is mechanically united with it, and the agitation kept up upon the bottom of the harbour will prevent the sand being deposited.

There is another mode already hinted at, of sand being collected, which the peculiar construction of harbours here described is equally well calculated to counteract. It is a fact well known to some of those who attentively observe the operations of nature, that all floating substances, especially such as do not rise above the surface of the water, approach the shore with a land wind, and recede from it by a contrary wind. This seems to arise from the violence of the wind upon the water causing the surface water to pass from the shore, and the under water to approach it, to supply its place by means of an opposite current. This under current is the more conspicuous in its operation, when the tide flows or ebbs in a contrary direction to that of the wind, and the floating substances carried along are accordingly deposited.

The consequence is, that wherever large solid buildings are erect-

ed in a current of water, which has a tendency to sand up, and where these buildings pass along the shore, the wind from the shore that passes over them causes a sand bank to be formed seaward of the building, and to bring it directly into the mouth of the harbour, if it happens to be in the line of that building. This fact is strongly exemplified by the sand already accumulated at the back of the wet docks at Leith, or the stone pier at Newhaven, and in many other situations.—*Dr. Brewster's Journal of Science.*

On Perforating and Cutting Glass, Earthenware, &c.

ALTHOUGH many persons are acquainted with methods of perforating glass, &c. the following easy one, I find, is not so generally known as it deserves to be, and I am therefore induced to explain the mode of operating I employ, in order to produce the best results. Circumstances often conspire to render the process valuable to persons situated at a distance from large manufacturing towns, and especially to those who are living in places where they cannot readily obtain the various chemical apparatus they may require for their purpose. I have frequently found the knowledge to be of importance, not only as regards the time saved, (and time is equal to money,) but the facility with which the various broken and otherwise useless articles of domestic economy may be converted by its aid into convenient and useful chemical apparatus.

It will be unnecessary at present to enter into a detailed account of the various apparatus that may be constructed by any person acquainted with the process—it being my intention, on another occasion, to describe a variety of such arrangements. My present object is to describe the method by which the effect may be produced with certainty and despatch.

The only tools requisite in this process, are a few worn out three-edged handsaw files; these being generally made of cast steel, retain, when ground, a very fine point, which is of the utmost importance. In order, however, to give them the requisite degree of hardness, it is necessary to make their ends, for about an inch, red hot, and then plunge them into cold water; by this treatment they become hard and brittle; care is therefore required in grinding them to a proper point; this is easily effected on a common grindstone. I generally give them a few rubs on a fine oil stone after the grinding, so as to produce a very fine point.

A cylindrical piece of any sort of wood, about two inches long, terminated by a half round end, having a hole about the tenth of an inch in diameter through its axis, may either be fastened into a common bench vice, or on a table; this constitutes the only support required.

Suppose that a glass to cover the face of a wheel barometer is wanted, through which it is sometimes necessary to make a perforation for the purpose of passing the screw of the nonius through: a proper piece of glass being selected is to be marked with a dot of ink on the

place where the intended perforation is to be made; the glass is then to be held horizontally by the left hand, on, and immediately over, the hole in the wood support above mentioned. A three edged file having been hardened, and ground to a fine point in the manner above described, is held firmly between the fore finger and thumb of the right hand, precisely in the position that a pen or pencil is retained when writing. The pointed steel is then to be repeatedly impinged against the glass over the spot intended to be perforated, taking care not to use too much violence; in a short time the outer surface is removed, and by a continuation of the process, a conical piece is forced from the under surface of the glass through the hole in the wood support; the perforation so produced, never exceeds in size a pin head, but may be made as large as required by holding it over the hole in the support, and working round its edge with a fine pointed file. In this way, after a little practice, and in a very few minutes, may be perforated with ease all descriptions of glass, from the thinnest crown to the thickest plate, without any danger. Indeed, I have frequently made four or five perforations in the space of an inch square, without any fear of starring the glass, as it is technically called.

When it is required to perforate glass globes, or the upper part of wine bottles, the wood support is of course unnecessary, as the figure of the vessel gives sufficient strength without it. Wine glasses or tumblers may also be easily perforated in a similar manner; but I mostly employ another process for them. These being made of a softer sort of glass, require only to be moved by the hand backwards and forwards in the manner of drilling, on the sharp point of the file, with the occasional assistance of a little oil and emery. Indeed, any sort of glass may be perforated in this manner with ease, but I think not so quickly as by the method of punching.

All the varieties of china and earthenware may be perforated by either of the above processes with certainty; and the ingenious experimentalist will find no difficulty in turning to account many otherwise useless articles by its assistance.

It may not be amiss to mention here an easy method, which I have occasionally employed with success, for separating the bottoms of phials from the other parts, &c.; I pour a small quantity of sand or emery into the angular turned up part of the vessel, with a few drops of water to moisten it; then by means of a piece of wood having a sharp point, I press the moistened sand, &c. into contact with the glass, and by gently turning the bottle round, bringing the point of the wood and the sand into contact with every part of the lower end of the phial in succession; by these means, the surface is quickly scratched, and immediately after a fracture takes place all round the bottle, which instantly separates the bottom; this effect does not take place with all sorts of bottles, but in very many it does.

J. Marsh.

[*Jour. Royal Institute.*

Meteorological Observations for October, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	44°	66°	30.07	30.04	40	NW. S.	Moderate.		Clear day.
	2	52	72	29.94	29.90	52	SW.	do.		Clear—serene.
	3	58	76	.76	.73	62	SW.	do.		Fog—clear.
	4	60	78	.70	.62	61	NE. SW.	do.	.34	Fog—flying cl'ds—r'n n't
	5	56	61	.50	.50	57	W.	Breeze.		Cloudy—clear.
	6	44	60	.70	.60	39	W.	Blustering.		Clear day.
⊗	7	40	60	30.05	30.04	37	W. SW.	Moderate.		White frost—clear.
	8	50	69	.00	29.90	49	N. S.	Blustering.		Cloudy day.
	9	66	69	29.60	.60	65	SW. W.	Moderate.	1.60	Rain—cloudy.
	10	45	46	.64	.55	48	N. NW.	do.	1.30	Rain.
	11	40	46	.43	.50	40	N. W.	Blustering.	1.50	Rain.
	12	40	56	.80	.85	36	N. W.	do.		Clear day.
☽	13	35	64	.95	.82	36	NW. W.	Moderate.		Frost—clear.
	14	56	68	.80	.86	46	SW.	do.		Clear day.
	15	43	63	30.16	30.14	40	N. SW.	do.		Clear day.
	16	51	63	.14	.06	52	W.	do.		Fog—cloudy.
	17	58	75	.00	29.93	51	W. SW.	do.		Clear day.
	18	54	74	29.83	.80	50	W.	do.	.05	Clear day—rain in night.
	19	47	62	.86	.86	42	W. NW.	do.		Clear day.
	20	43	62	.95	.95	36	W.	do.		Clear day.
☺	21	44	51	30.00	30.00	47	W.	do.		Clear day.
	22	51	66	.05	.05	49	SE. S.	do.		Fog—cloudy.
	23	59	74	.00	29.95	58	SE.	do.		Flying clouds—clear.
	24	56	62	29.72	.72	67	S. W.	Blustering.	1.90	Rain—clear.
	25	42	62	30.10	30.20	36	W.	Moderate.		Clear day.
	26	45	66	.20	.20	46	S. SSE.	do.		Foggy—clear.
	27	65	54	29.95	29.90	46	S. W.	Blustering.		Fog—rain.
☾	28	32	50	30.00	30.00	33	NW.	Moderate.		Clear day.
	29	34	54	.16	.20	33	N. NE.	do.		Clear day.
	30	40	56	.10	29.94	26	NW. E.	do.	.02	Clear day—rain in night.
	31	44	53	29.65	.60	46	NE. W.	do.		Cloudy—clear.
	Mean	48.58	62.52	29.90	29.87	46			6.71	

		Thermometer.	Barometer.
Maximum height during the month,		78. on 4th.	30.20 on 25th.
Minimum	do. . .	32. on 28th.	29.43 on 11th.
Mean	do. . .	55.55 . . .	29.88

JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

DECEMBER, 1831.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Description of an apparatus, called the Rotascope, for exhibiting several phenomena, and illustrating certain laws of rotary motion. By Walter R. Johnson.—(*With a Plate.*)

Our common books of mechanics generally contain concise accounts of the doctrines of rotary motion, limited for the most part, however, to the consideration of central forces, the centre of percussion and of gyration, and the centre of spontaneous rotation, to which may be added, the laws of oscillatory motion.

The forces tending to change the position of the axis of rotation are generally either wholly omitted, or if concisely stated in an abstract form, are apparently regarded as incapable of experimental illustrations. The whirling table of Mr. Ferguson is an ingenious apparatus for exhibiting the amount and direction of the several forces exerted by a body in its own fixed plane of revolution. But that instrument makes no provision for the phenomena above referred to.

When we consider that the extensive diffusion of a branch of knowledge, often depends on the facility with which its elements can be made apparent to the understanding, we are at no loss in estimating the practical value of philosophical instruments, whether intended for demonstration or for research. Of this truth the machine of Attwood may be taken as an illustration. This machine gives a most elegant and satisfactory exhibition of the principles of uniform, accelerated, and retarded motions, as dependant on the force of gravity.

All the motions in the machine may be so slow as to reduce the resistance of the air to an unimportant element, and the friction and inertia of the parts being separately determined and allowed for, the theoretical laws of motion are seen to be perfectly confirmed by the experiments.

As to the manner in which the principles of rotation have generally been explained, it may be briefly stated on the plan of what are called rectangular co-ordinates. As, by referring the effect of any force applied opposite to the centre of gravity of a body at rest, to three lines mutually crossing each other at right angles, the resulting direction which the centre of gravity of that body will take in free space, is inferred; so, by a consideration of three perpendicular axes of revolution within the body itself, we may determine the effect of any number of forces tending to produce rotation. Combining these two together we have the resultant motions both of rotation and translation. One of the most important propositions pertaining to the physical character of the subject, is that discovered and demonstrated by Frisi; that "when a body revolves on an axis, and a force is impressed, tending to make it revolve on another, it will revolve on neither, but on a line in the same plane with them, dividing the angle which they contain so that the sines of the parts are in the inverse ratio of the angular velocities with which the body would have revolved about the said axes separately."

The following are among the elementary experiments and observations which led to the construction of this instrument.

1. When we take up by its brazen meridian a common artificial globe, and, having given it a rapid motion about its axis, attempt to move the poles from their position, we shall find our efforts resisted, or the globe impelled in various directions, in a manner which will generally surprise those to whom the experiment is new. If the globe be held by the meridian, at points over the equatorial circle of the sphere, and the axis placed nearly vertical, and in this state of things the revolving globe be carried alternately from the right to left, and the reverse, by the extended arms as in a small orbit, or portion of an orbit, the tendency of the sphere to change the position of its axis will be felt in one or both directions of the movement.

2. There is in use a small apparatus for striking fire, composed of a semicylindrical box of tinned iron, a few inches in length, at one end of which is a small cavity for receiving the tinder, and above it is mounted, on an axis, a disk of steel to strike, when in rapid motion, upon a flint, held just above the tinder. The steel disk is put in motion by the friction of a string drawn briskly over a pulley on the axis. If, when the wheel in this apparatus, (which is about two inches in diameter,) is revolving vertically, we hold the whole loosely in the hand extended, and carry the latter alternately right and left before the body, so as to cause the wheel to describe a horizontal curve, to which the direction of its axis at the commencement of the motion is a tangent, we shall perceive a strong tendency in the wheel to leave the vertical and assume the horizontal position.*

3. A small apparatus, said to have been devised by the celebrated Laplace to illustrate the precession of the equinoxes, has been made in France, and imitated by an ingenious mechanic of Philadelphia.

* This neat little experiment had been made and was first communicated to me by Mr. William Mason, who, to render it the more striking, had mounted the whole box on a pointed axis passing longitudinally through the centre of gravity.

It is formed of two concentric rings revolving on axes at right angles to each other. Within the inner ring is a small spheroid, loaded at one of its poles in such a manner as to produce a rotation in the axis of the inner ring when the spheroid is caused to revolve with rapidity. The chief parts of the rotascope had been devised and constructed before I had an opportunity of seeing the above described apparatus.

4. A number of ingenious experiments were some time ago contrived and executed by Mr. Rufus Tyler, a skilful mechanician of Philadelphia, with an apparatus resembling, in some respects, the common *top;* included in a ring, and placed on a whirling table.

In that arrangement his experiments coincided to a certain extent with some of those which are presented with the rotascope on the orbit-rod.

There was wanting, however, the means of developing and exhibiting the causes which produce the changes which are actually seen to take place. This end is most important in whatever concerns the principles of mechanics. It is what constitutes the great beauty of Attwood's experiments, that the action of gravity is made to coincide, *in principle*, with its actual operation when unrestrained; while, at the same time, the bodies submitted to its action, move with velocities which can be readily followed by the eye.

The following description refers to the accompanying plate:—

A, is a fly wheel, about eight inches in diameter, formed in such a manner as to receive but slight resistance from the air. It is supported on the centre of a perfectly cylindrical axis about $\frac{3}{8}$ of an inch in diameter, terminated by cones to serve as pivot points, on which the wheel runs. The wheel is of brass, the axis of steel, one part, from the wheel towards the pivot, being polished, the other bronzed, for more readily distinguishing the changes of position. The wheel and its axis weigh about 2 lbs. 11 oz.

B, is the base or tripod of mahogany, which sustains the instrument.

F, is a wooden frame containing the principal moving parts of the apparatus.

1, 2, 3 are concentric metallic rings, each about $\frac{3}{4}$ of an inch in breadth, and about $\frac{2}{10}$ of an inch in thickness. The exterior one, (3,) being about fifteen inches exterior diameter, is sustained in its place by the screws *s*, *s*, which have their ends conically excavated to receive the pivot. The axis of the next ring, (2,) is at right angles to that of 3, and again the axis of 1, is at right angles to that of 2, and the axis of the wheel A, to that of the ring 1.

The centre of gravity of the wheel is likewise that of the whole system, and the axis of motion of each ring passes through that centre.

e, is a pivot to the vertical shaft *e*, *f*, upon which the frame F is supported, and upon which it may revolve. The axis of this shaft likewise passes through the centre of the wheel A.

f, is a socket and cone furnished with a tightening screw.

t, is a thumb-screw to fasten and hold the axis *e*, *f*, whenever it becomes necessary to prevent the horizontal motion of the frame F.

p, *p*, are two pulleys attached to the two upright pieces of the frame by metallic bands, and held fast, at any convenient height, on these supports by a screw on the back side; by taking out the screws *s*, *s*, the pulleys may be carried below the axis of the outer ring.

u, *u*, are nuts to keep in place the upper piece of the frame, and having a hole drilled through their heads to receive cords by which the whole frame may be suspended from the ceiling; and *h*, *h*, are two hooks for a similar purpose, and likewise for suspending other weights when not in use.

M, M, are weights acting as moving forces, to set the wheel A in motion. For these weights, the hand of the experimenter may, in many cases, be conveniently substituted, especially where it is not important to know the precise velocity attained. The cord is attached to the axis by means of the small projecting conical knob *k*, to which the centre of the cord is connected by doubling it, applying the pin to the double part, and then setting the wheel in motion to wind up the cord, so that one end will be drawn off from above, the other from below, and both tend to turn the wheel in the same direction.

c, *c*, are two cords connected with the axis of the ring 2, and passing over the pulleys *p*, *p*.

W, W, are weights attached to these cords.

z, indicates the direction in which those weights tend to turn the ring 2 about its axis. This direction is reversed by winding up the cord in the opposite direction.

w, *w*, are weights applied to pulleys firmly connected with the axis of circle 1, and tending to produce a rotation in the direction opposite to that indicated by *v*.

m, is a weight suspended or otherwise attached to the same circle, and tending to produce rotation in the direction of *v*.

x, denotes the direction in which the wheel will move when actuated by the forces M, M, as here represented; but by turning the wheel in the opposite direction, when the cord is applied over the knobs, it will be put in motion in the opposite direction, and the ring 2, will also move opposite to *z*, by the force of *m*.

O, is a bar of mahogany, called the orbit-rod, six feet in length, with a socket, by means of which it may, when the frame F is removed, be placed on the pivot *e*, and made to revolve. In this case the frame containing the wheel is to be set, or suspended, at one end, while at the other is suspended the weight C, which exactly counterpoises the frame and its appurtenances. This weight is placed below the bar in order to bring the centre of gravity as low as practicable, and produce a more stable equilibrium.

The following directions and cautions in using the rotascope will be found useful to those who may not be familiar with its action.

In winding up the *moving cord* around the axis of the wheel, it is necessary to keep the two ends as near to each other as practicable without having one *overlay*, or actually rub against, the other, and to have them wound from beginning to end of the spiral, parallel to each other, without crossings, as the latter will materially obstruct the un-

coiling when the force is applied, and endanger the breaking of the cord.

Care should be taken that the uncoiling be made in such a position of the rings that the moving cord will free itself immediately from all contact with the wheel, at the instant it leaves the shaft.

The cords applied to the several pulleys on the first and second rings, should be kept closely wound round their respective pulleys when not wanted for immediate use, as they may otherwise become entangled in the wheel and obstruct its motion, or essentially endanger the accuracy and safety of the whole instrument.

In using the orbit-rod, the weights should be attached first, then the frame, F, put in its place, and finally, set upon the pivot *e*, when the base, B, will sustain the whole. The revolution should begin with a slow motion, and increase in velocity—all shocks and sudden changes of motion should be avoided.

When it becomes necessary to add any weights to the rings or other parts of the apparatus while on the orbit-rod, an equal weight should be added to the *counterpoise* to avoid lateral pressure on the pivot *e*.

When the *elementary particles* are placed on the axis, the changes of position of the rings should be made gradually, to avoid violent blows of the particles upon the ring 1; otherwise, they may bruise its edge, and be thrown off with violence.

When the wheel is to be stopped, it is most convenient and safe to do it by applying a moderate friction with the fingers to the axis.

To set the wheel in motion, apply the cord round the axis of the wheel, doubling it for that purpose, and putting the fold at the centre over the small pin near the end of the axis. Having wound up the cord, take one end in each hand, and draw the two ends apart with suitable force in directions at right angles to the axis, and as nearly as may be in the plane of the first circle, as well as parallel to the wheel itself.

The following are among the experiments which may be performed by the aid of the rotascope.

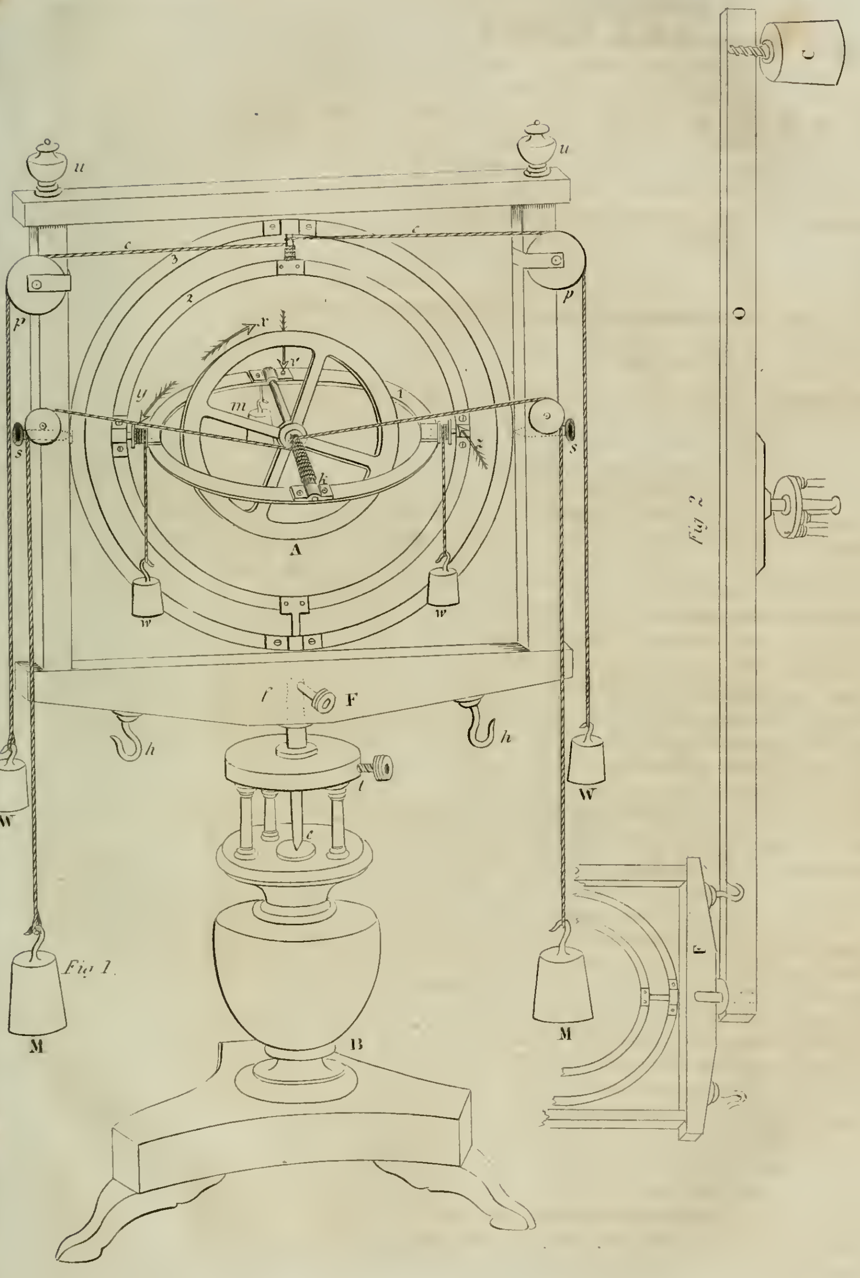
1. Take the wheel and its supporting circle from the frame. Connect with the ring, at a point opposite to the axis of the wheel, a wooden rod of sufficient strength to bear the weight when held horizontally, and from nine to twelve inches in length. Attach the end of this rod, remote from the wheel, to a cord suspended from the ceiling. Set the wheel in rapid motion, and then bring it up so that the rod shall be horizontal. Then suddenly abandoning it with the hand, the cord will sustain it, but instead of hanging vertically down, the axis of the wheel and rod, which may be regarded as its prolongation, will be kept for some time horizontal; but though thus suspended, as if by some mysterious agency, they constantly perform a circuit which has an *imaginary vertical* drawn from the point of suspension, for its axis. If the velocity of the horizontal revolution be diminished, the sustaining rod will incline downwards more rapidly than when left to itself, until at length it reaches the position of rest. But if the velocity of revolution be augmented by any external force, the wheel and ring will rise in opposition to gravity until the rim of the

wheel strikes the suspending cord. The wooden rod will then have come to a position nearly vertical, sustaining the wheel and ring at its upper end, but still continuing the horizontal motion. This paradoxical appearance, would continue the longer by having a delicate metallic swivel link in some part of the cord, which would prevent the twist that otherwise soon opposes the horizontal motion to such an extent as to depress the rod in the course of a few minutes. It will be seen that the revolution in a horizontal direction, being the resultant of gravity, combined with the rotary motion of the wheel, must become more rapid in proportion as the velocity of the latter on its axis is diminished: because the force of gravity is then a greater component in the combined forces which act upon the system.

2. Having replaced the wheel and ring, in their connexion with the frame, set the latter on its pivot upon the base, B. Make the circle, or ring, 3, fast in a vertical position, apply cords to the pulley on the axis of ring 2, and bringing the pulleys *p*, *p*, to a proper elevation; make them fast, and pass those cords over them to sustain weights. Having given the wheel a rapid motion, take hold of one of the urns *u*, *u*, and cause the whole frame to revolve horizontally on its pivot. As the persistency of the wheel in the plane of its motion prevents the ring 2 from revolving, the motion of the frame will gradually wind up the cords about the pulley. At the same time, however, the ring 1 will gradually change its plane, and bring the wheel to a position to obey the action of the weights. The portion of cord which had been previously wound about the pulley will then be uncoiled, and a considerable momentum communicated to the system composed of the rings 1 and 2, which will, if the tightening screw, *t*, be made fast, again wind up the cord in the opposite direction about the pulley. As soon as the said rings, however, are again deprived of their momentum by the action of the weights, the latter will again tend to produce a rotation in the ring 2, which will be opposed by the persistency of the wheel. If, at this moment, the pivot be released from the screw, the whole system, composed of the two weights, the frame, and ring 3, will be made to revolve by the gravity of the weights, while the ring 2 remains pertinaciously fixed in its position, until the wheel has had time again to invert its axis. This time will be greater or less according to the greater or less velocity of rotation in the wheel, compared with the size of the weights hanging over the pulleys.

3. Set, or suspend, the frame on the orbit rod. Give the wheel a moderate velocity of rotation, and set the whole in motion upon the pivot *e*, all the circles being free to move on their respective axes. In whatever direction the wheel revolves, with respect to the plane of the orbit, at the commencement of the *orbicular* revolution, it will soon be observed to conform in direction to the latter. If *this* be reversed, *that* will soon be reversed also.

4. Repeat the third experiment with only the addition of a weight of eight ounces attached to the second circle, opposite to the axis of the first. The effort of the wheel to take and maintain in its rotation the direction of this orbicular motion, will be sufficient to keep the weight elevated nearly to a level with the centre of the wheel.



ROTASCOPE BY W. R. JOHNSON.

Continuation of the Report of the Committee of the Franklin Institute of Pennsylvania, appointed May, 1829, to ascertain, by experiment, the value of Water as a Moving Power.

(Continued from p. 305.)

TABLE L.—PART I.

CHUTE No. 5.—*Elbow buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	7.75	9.33	10.41	1.50	566	48.95	614.95	41.5	33	11.84	5425	14.75	800187	255204	.319			
2					669	50.58	719.58		36	10.86	6075		896062	298624	.333	.333	10.86	
3					772	52.21	824.21		42	9.31	7025		1036187	342046	.330			
4					875	53.84	928.84		49	7.98	8175		1206812	385468	.319			
5	7.00	8.58	9.66	1.50	566	48.95	614.95	51.5	34	11.50	5505	14.00	770700	255204	.330			
6					669	50.58	719.58		38	10.28	6230		872200	298624	.342	.342	10.38	
7					772	52.21	824.21		44	8.88	7225		1011500	342046	.338			
8	7.00	8.58	9.66	1.75	566	48.95	614.95	41.5	32	12.20	5350	14.00	749000	255204	.340			
9					669	50.58	719.58		34	11.50	5925		829500	298624	.359			
10					772	52.21	824.21		39	10.02	6735		942900	342046	.362	.362	10.02	
11					875	53.84	928.84		45	8.71	7880		1103200	385468	.349			
12					978	55.47	1033.47		51	7.66	8880		1243200	428889	.345			
13	6.00	7.58	8.66	1.50	566	48.95	614.95	41.5	40	9.77	5700	13.00	741000	255204	.344			
14					669	50.58	719.58		41	9.54	6300		819000	298624	.364	.364	9.54	
15					772	52.21	824.21		49	7.98	7525		978250	342046	.349			
16	6.00	7.58	8.66	1.75	669	50.58	719.58	41.5	37	10.57	6075	13.00	789750	298624	.378	.378	10.57	
17					772	52.21	824.21		44	8.88	7050		916500	342046	.373			
18					875	53.84	928.84		50	7.82	8230		1069900	385468	.360			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table L.—Part II.

Chute No. 4.—*Elbow buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
19	6.00	7.58	8.66	2.00	566	48.95	614.95	41.5	31	12.60	5400	13.00	702000	255204	.363			
20					669	50.58	719.58		35	11.16	5950		773500	298624	.386	.386	11.16	
21					772	52.21	824.21		40	9.77	6950		903500	342046	.378			
22	5.00	6.58	7.66	1.25	566	48.95	614.95	41.5	46	8.50	5850	12.00	702000	255204	.363	.363	8.50	
23					669	50.58	719.58		56	6.98	7165		859800	298624	.347			
24	5.00	6.58	7.66	1.50	669	50.58	719.58	41.5	46	8.50	6490	12.0	778800	298624	.383	.383	8.50	
25					772	52.21	824.21		55	7.10	7950		954000	342046	.359			
26	5.00	6.58	7.66	1.75	772	52.21	824.21	41.5	49	7.98	7510	12.00	901200	342046	.379	.379	7.98	
27					875	53.84	928.84		58	6.74	8580		1029600	385468	.374			
28	5.00	6.58	7.66	2.00	669	50.58	719.58	41.5	39	10.02	6135	12.00	736200	298426	.405	.405	10.02	
29					875	53.84	928.84		54	7.24	8425		1011000	385468	.381			
30	4.00	5.58	6.66	1.00	360	46.61	406.61	41.5	46	8.50	4525	11.00	497750	168743	.339			
31					463	48.48	511.48		54	7.24	5350		588500	212264	.360	.360	7.24	
32					566	50.35	616.35		68	5.75	6500		715000	255785	.357			
33	4.00	5.58	6.66	1.50	463	48.48	511.48	41.5	38	10.28	5050	11.00	555500	212264	.382			
34					566	50.35	616.35		43	9.09	5675		624250	255785	.409	.409	9.09	
35					669	52.22	721.22		52	7.52	6800		748000	299306	.400			
36					772	50.09	826.09		64	6.10	8350		918500	342827	.373			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE L.—PART III.

CHUTE No. 5.—*Elbow buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
37	3.00	4.58	5.66	1.50	463	48.48	511.48	41.5	41	9.54	5000	10.00	500000	212264	.425			
38					566	50.35	616.35		49	7.98	5800		580000	255785	.441	.441	7.98	
39					669	52.22	721.22		57	6.86	6900		690000	299306	.433			
40	3.00	4.58	5.66	1.75	566	50.35	616.35	41.5	44	8.88	5575	10. 0	557500	255785	.459	.459	8.88	
41					669	52.22	721.22		52	7.52	6650		665000	299306	.450			
42					772	54.09	826.09		64	6.10	8100		810000	342827	.423			
43	3. 00	4.58	5.66	2.00	566	50.35	616.35	41.5	42	9.31	5500	10.00	550000	255785	.465	.465	9.31	
44					669	52.22	721.22		51	7.66	6700		670000	299306	.447			
45	2.00	3.58	4.66	1.00	257	44.74	301.74	41.5	51	7.66	3125	9.00	281250	125222	.445			
46					360	46.61	406.61		66	5.92	4025		362250	168743	.466	.466	5.92	
47					463	48.48	511.48		85	4.60	5225		470250	212264	.451			
48	2.00	3.58	4.66	1.25	257	44.74	301.74	41.5	40	9.77	3800	9.00	342000	125222	.366			
49					463	48.48	511.48		60	6.50	5175		465750	212264	.455	.455	6.50	
50					566	50.35	616.35		67	5.84	6450		580500	255785	.440			
51					669	52.22	721.22		81	4.83	7675		690750	299306	.433			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE L.—PART IV.

CHUTE No. 5.—*Elbow buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of Water above. Btm. of gate.	Head of Water above. Top of bkt.	Head of Water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
52	2.00	3.58	4.66	1.50	360	46.61	406.61	41.5	42	9.31	4350	9.00	391500	168743	.431			
53					463	48.48	511.48		50	7.82	5150		463500	212264	.458			
54					566	56.35	616.35		59	6.62	6150		553500	255785	.462	.462	6.62	
55					669	52.22	721.22		72	5.43	7425		668250	299306	.448			
56	2.00	3.58	4.66	1.75	463	48.48	511.48	41.5	45	8.71	5125	9.00	461250	212264	.460			
57					566	50.35	616.35		55	7.10	6025		542250	255785	.471	.471	7.10	
58					669	52.22	721.22		66	5.92	7250		652500	299306	.459			
59					772	54.09	826.09		78	5.01	8600		774000	342827	.443			
60	2.00	3.58	4.66	2.00	463	48.48	511.48	41.5	45	8.71	5075	9.00	456750	212264	.464			
61					566	50.35	616.35		54	7.24	6000		540000	255785	.473	.473	7.24	
62					669	52.22	721.22		64	6.10	7150		643500	299306	.465			
63	1.00	2.58	3.66	2.00	360	46.61	406.61	41.5	53	7.38	4000	8.00	320000	168743	.527			
64					463	48.48	511.48		65	6.00	4930		394400	212264	.539	.539	6.00	
65					566	50.35	616.35		82	4.77	6025		482000	255785	.530			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Table M.—Part I.

Chute No. 5.—*Centre buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Head of water above. Top of bkt.	Head of water above. Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
1	7.75	9.33	9.33	1.00	257	44.06	301.06	41.5	30	13.00	3675	14.75	542062	124950	.230			
2					360	45.69	405.69		33	11.84	4125		608437	168361	.276			
3					463	47.32	510.32		38	10.28	4625		682187	211782	.310			
4					669	50.58	719.58		48	8.14	5050		862875	298624	.345			
5					772	52.21	824.21		53	7.38	6500		958750	342046	.356	3.56	7.38	
6					875	53.84	928.84		61	6.40	7425		1095187	385468	.351			
7					978	55.47	1033.47		75	5.21	8775		1294312	428889	.331			
8	7.75	9.33	9.33	1.25	669	50.58	719.58	41.5	37	10.56	5475	14.75	807562	298624	.368			
9					772	52.21	824.21		40	9.77	6050		892375	342046	.383			
10					875	53.84	928.84		44	8.88	6685		986037	385468	.390	.390	8.88	
11					978	55.47	1033.47		50	7.82	7525		1109937	428889	.386			
12					1081	57.10	1138.10		56	6.98	8450		1246375	472310	.378			
13	7.75	9.33	9.33	1.50	772	52.21	824.21	41.5	35	11.16	5820	14.75	858450	342046	.398			
14					875	53.84	928.84		38	10.28	6375		940312	385468	.410			
15					978	55.47	1033.47		43	9.09	7050		1039875	428889	.412	.412	9.09	
16					1081	57.10	1138.10		47	8.32	7875		1161562	472310	.407			
17	7.75	9.33	9.33	1.75	875	53.84	928.84	41.5	37	10.56	6250	14.75	921875	385468	.418			
18					978	55.47	1033.47		38	10.28	6725		991937	428889	.432	.432	10.28	
19					1081	57.10	1138.10		42	9.31	7500		1106250	472310	.427			
20					1184	58.73	1242.73		46	8.50	8325		1227937	515733	.420			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE M.—PART II.

CHUTE NO. 5.—*Centre buckets. Close Breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate.	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	W't of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
21	5.00	6.58	6.58	0.75	463	47.32	510.32	41.5	56	6.98	4830	12.00	579600	211782	.365			
22					566	48.95	614.95		67	5.84	5700		684000	255204	.373			
23					669	50.58	719.58		86	4.54	6600		792000	298624	.377	.377	4.54	
24	5.00	6.58	6.58	1.00	566	48.95	614.95	41.5	48	8.14	5375	12.00	645000	255204	.395			
25					669	50.58	719.58		55	7.10	6050		726000	298624	.411			
26					772	52.21	824.21		63	6.20	6885		826200	342046	.414	.414	6.20	
27					875	53.84	928.84		72	5.43	7950		954000	385468	.404			
28					978	55.47	1033.47		84	4.65	9215		1105800	428889	.387			
29	5.00	6.58	6.58	1.25	669	50.58	719.58	41.5	44	8.88	5775	12.00	693000	298624	.430			
30					772	52.21	824.21		48	8.14	6460		775200	342046	.441			
31					875	53.84	928.84		55	7.10	7265		871800	385486	.442	.442	7.10	
32					978	55.47	1033.47		62	6.30	8250		990000	428889	.433			
33	5.00	6.58	6.58	1.50	772	52.21	824.21	41.5	43	9.09	6250	12.00	750000	342046	.456			
34					875	53.84	928.84		49	7.98	7000		840000	385468	.458	.458	7.98	
35					978	55.47	1033.47		55	7.10	7875		945000	428889	.453			
36	5.00	6.58	6.58	1.75	772	52.21	824.21	41.5	40	9.77	6200	12.00	744000	342046	.459			
37					875	53.84	928.84		45	8.70	6800		816000	385468	.472	.472	8.70	
38					978	55.47	1033.47		50	7.82	7660		919200	428889	.461			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

TABLE M.—PART III.

CHUTE No. 5.—*Centre buckets. Close breast. Bottom of gate 7 feet above bottom of wheel.*

No. of Exper't.	Head of water above. Btm. of gate	Top of bkt.	Btm. of bkt.	Width of Aperture.	Weight raised.	Friction.	Sum of friction and weight raised.	Height raised.	Time.	Velocity per second.	Wt of water expended.	Head and fall.	Power.	Effect.	Ratio, power being 1.	Maximum effect.	Velocity at maximum.	Observations.
	Feet.	Feet.	Feet.	In.	Pds.	Pounds	Pounds.	Feet.	Scds.	Feet.	Pds.	Feet.						
39	2.00	3.58	3.58	0.75	257	44.74	301.74	41.5	62	6.30	3025	9.00	272250	125222	.460			
40					360	46.61	406.61		78	5.01	3955		355950	168743	.474	.474	5.01	
41					463	48.48	511.48		105	3.72	5200		468000	212264	.453			
42	2.00	3.58	3.58	1.00	360	46.61	406.61	41.5	51	7.66	4200	9.00	378000	168743	.446			
43					463	48.48	511.48		62	6.30	5000		450000	212264	.471			
44					566	50.35	616.35		71	5.50	5840		525600	255785	.486	.486	5.50	
45					669	52.22	721.22		83	4.71	6850		616500	299306	.485			
46					772	54.09	826.09		102	3.83	7900		711000	342827	.482			
47	2.00	3.58	3.58	1.25	463	48.48	511.48	41.5	51	7.66	4850	9.00	436500	212264	.486			
48					566	50.35	616.35		58	6.74	5555		499950	255785	.511			
49					669	52.22	721.22		68	5.75	6450		580500	299306	.516	.516	5.75	
50					772	54.09	826.09		77	5.07	7450		670500	342827	.511			
51					875	55.96	930.96		88	4.44	8640		777600	386349	.496			
52	2.00	3.58	3.58	1.50	566	50.35	616.35	41.5	53	7.38	5450	9.00	490500	257785	.525			
53					669	52.22	721.22		62	6.30	6260		563400	299306	.531	.531	6.30	
54					772	54.09	826.09		71	5.50	7225		650250	342827	.525			
55					875	55.96	930.96		82	4.77	8340		750600	386349	.515			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

[TO BE CONTINUED.]

FRANKLIN INSTITUTE.

Explosions of Steam Boilers.

Continued from p. 315.

(No. XI.)

Letter from L. Hebert, Esq., of London, in reply to the Circular of the Committee of the Franklin Institute.

20 *Paternoster Row, London,* 12 *October,* 1830.

Although I cannot have the satisfaction of furnishing you with any very important evidence on the subject, which the committee of your valuable institution have so laudably undertaken to investigate; yet, with the hope that the addition of my "mite," may tend in some degree to promote the object you have in view, I venture to give you a brief detail of my limited experience and observation; to which I shall take leave to add a few suggestions for improving the apparatus connected with the generation of steam.

It has never fallen to my lot to be present during the explosion of an *ordinarily constructed* steam-engine boiler, but I have seen the condition of several immediately, or soon after, that occurrence, and have obtained information upon which I can rely, respecting many of the circumstances attending them. I have, however, "stood fire" several times in the experimental disruption of tubular boilers, from a conviction of their innocuous effects, which I shall more particularly notice in the course of this letter.

With respect to the common capacious boilers, the first instance I shall mention was that of a long cylindrical boiler, distinguished in England by the name of Trevithick, as the presumed inventor,* in which three separate burstings took place in precisely the same part of the boiler;—in that part immediately above the strongly ignited fuel of the furnace, and extinguishing the fire each time, but without causing any further material damage: the pressure in each case being upwards of fifty pounds upon the inch. The boiler was made of the best malleable iron. Previous to the disruption there was observed a bulging, or swelling out, of the metal, which gradually increased till it became nearly of a hemispherical figure, when it burst open and let the water out of the boiler into the fire. The boiler was repaired by putting a thick patch of malleable plate iron over the hole, when, after about six weeks wear and exposure to the fire, this metal bulged out again, and burst asunder; a third patch was substituted, and in about a similar period of time, was destroyed in the like manner. As the third disaster might naturally be expected from the results experienced in the first and second, it is proper to notice that the urgent wants of the manufactory were such as to render it expedient to get the engine into working order, notwithstanding that circumstance. The cause of these ruptures appeared upon investigation to be owing

* I am inclined to think that your countryman, Oliver Evans, was the earliest inventor of this long boiler; if so, the merit of our justly celebrated Trevithick, will, in *this* instance, be merely that of having spoiled "a good original," by his having increased the diametrical proportions of the cylinder.

to a partial and very intense heat impinging against that particular spot where they took place. A positive proof of this might very likely have been afforded by an alteration in the flue, but the working of the engine was, after the last accident, discontinued. This boiler was not set with the furnace in its usual situation, but underneath it, at one end; the heated air and flame, consequently, after impinging against the bottom, suddenly turned off at right angles to the remotest end of the boiler where it first entered the internal flue, and the air for combustion was supplied by means of what the masons here call an *air-drain;* consisting of a narrow subterraneous channel leading from the external atmosphere, (that is, outside of the building,) into the ash pit, where it terminated in a small opening near to, and directly under, the furnace bars; consequently, producing the effect of a continuous blast upon that part of the boiler where the current of air first impinged.

I am strengthened in this opinion by the information derived from a friend, that Mr. John Martineau, (a respectable engineer of London,) had a boiler which was twice destroyed in the same spot; upon endeavouring to ascertain the cause, Mr. Martineau discovered a fissure in the brick-work exactly opposite that part of the boiler where the ruptures took place; through this fissure the air rushed with great impetuosity, producing the effect of a blow-pipe upon the metal.

By a reference to the description of the boiler adopted by Messrs. Braithwaite and Ericsson, (inserted in the "Journal of the Franklin Institute,") in the "Novelty" steam carriage, it will be perceived that that part of their boiler where the flue first takes a horizontal course is exceedingly exposed to the destructive influence of the fire, especially when the strong blast they employ is superadded. For having pointed out the imminent risks of explosions incurred by this arrangement of the flue, my motives were impugned and misrepresented; although my intention was chiefly to show the cause of an acknowledged effect, that might have been attended with very serious disaster. My reason for mentioning this circumstance here, is, that as Messrs. Braithwaite and Ericsson's boiler has been trumpeted forth by the British press, generally, as a perfect model for imitation, it may come under the notice of your committee, who will probably decide, whether the arrangement of the parts, (however excellent in some respects,) is not calculated to cause an early disruption of that part of the boiler, where the flue first takes a horizontal course? I beg leave also to submit an opinion to your committee, that in forming the flues of steam boilers generally, all sudden bends should be avoided as dangerous, especially such as cause the current of flame and heated gases to strike partially against the boiler; and if a blowing apparatus be used, that the air should be uniformly distributed over the ash-pit, before it reaches the furnace bars;—and in the case of using an exhausting apparatus in the chimney, the same attention should be paid to a uniform distribution of the air, so as to avoid all partial currents.

Although boilers that are constructed with flues running through them, seem to be well contrived for economising heat, (and it is on this account, I conjecture, that they have received so general a pre-

ference,) there results from this arrangement a source of danger, from the deposit of soot becoming ignited. I make no doubt that many boilers have been destroyed owing to this circumstance, and I can instance one case in which this was *ascertained* to have been the cause: it was that of a high pressure boiler at Adams' Forge, Wednesbury, in Staffordshire, which exploded a few years ago, killing the proprietor, Mr. Adams, and five of his men, besides dreadfully injuring six other persons. The steam in the boiler was at the usual working pressure of sixty pounds, the safety valve was in good order, and there was plenty of water in the boiler. The flue from the furnace, before entering the chimney, passed through the steam chamber in the upper part of the boiler, where a quantity of soot was collected, which having been ignited, caused the surrounding metal to become red hot. In consequence, so sudden and powerful an expansion of the high pressure steam took place, as to render the aperture of the safety valve inadequate to carry off the steam as fast as it was generated, and the catastrophe ensued. The boiler, although formed of the best malleable iron plates, was separated into about fifty parts, which were scattered in all directions and to great distances. This single fact seems to me to place the *danger* of such an arrangement of parts in a pretty clear point of view, and I think we may therefore safely conclude that the plan is at least ineligible.

I shall now, sir, mention a fact that came under my observation, which shows the unfitness of boilers of large capacity or surface being employed for locomotive purposes, (wherein the steam is of no practical use, unless of very great elastic force,) and likewise the positive necessity of having a *principal* safety valve placed out of the control of the attending engineer, who is, naturally, very apt, (as I have had occasion frequently to notice,) to become excited at a moment of difficulty to do very imprudent things.

About three years ago, I was invited to attend an excursion of Messrs. Burstall and Hill's locomotive steam coach, from Lambeth, near London, but I declined being present, expressing my fears of the safety of the boiler. Several of my acquaintances, who did attend, were brought home wounded from the explosion of the boiler, and one of them nearly fatally by a large piece of the boiler striking him, and he was necessarily deposited in the nearest hospital. The wheels of the carriage had got into some loose ground, and the power of the engines appearing inadequate to extricate them, the engineer leaned with his weight upon the safety valve to get an accumulation of power for the purpose. At this time the boiler gave, to the persons surrounding the machine, alarming indications of its weakness, which induced many of them to retire from it; but a friend of mine who was behind it, had the boldness to advance and throw wide open the furnace door; the act was barely completed when the explosion took place, and he was both lacerated and scalded; none were "killed-off," (to use the *humane* expression of one of our now killed-off Ministers of War.) This boiler, like the last mentioned, was made of the best wrought or malleable iron, yet it flew into *pieces*, in spite of those wiseacres who assert that boilers of such iron "only *tear* open."

It was of a circular figure, very shallow, with a dome top, the interior being braced together by iron bars, upon the principle of trussing roofs in architecture.

The most frequent cause of disaster, has been, I believe, a deficiency of water in the boiler, owing to the failure, or imperfect action of the pumps. Several instances of this have come to my knowledge, but I am not in possession, at present, of the particular circumstances attending them, and shall therefore only mention one; which was that of a wrought iron boiler, with a spherical top, of Boulton & Watt's construction, employed at Aston Forge, near Birmingham. In this case it was ascertained that the explosion was caused by the boiler becoming red hot, into which the water was subsequently injected by the force pump, producing so instantaneous and powerful a volume of steam, as to overcome the resistance of the vessel.

Your committee is doubtless fully acquainted with all the facts that have appeared in print, respecting the explosion of steam boilers in this country. I allude, in particular, to the evidence given before committees of the British House of Commons appointed for that purpose.

Although the fates have never permitted me to be present during the explosion of a *common* boiler, (by which I mean all those having vessels of large capacity,) they have allowed me repeatedly to gratify my curiosity by observing the innocuous effects of the bursting of the small distinct chambers of tubular boilers, produced by the forcing of water into them, when the metal was at a bright red, or approaching to a white, heat. The explosion, though alarming to a stranger at first, from the noise and violent ejection of the vapour, is such as to give him confidence to "stand fire" in subsequent experiments. In all those that I witnessed, a *rending* of the metal was uniformly produced, of from one to three or four inches in length, and it usually occurred in that part of a tube where the welding had been more or less imperfectly performed, or where, from other causes, the metal was reduced in thickness. The internal diameter of the tubes in question was barely one inch, the thickness three-sixteenths, generally, but in the weakest places about an eighth of an inch. Although the force of steam to produce such effects might safely be estimated at several hundred pounds upon the inch, as a minimum, the maximum cannot be ascertained without knowing how far the tenacity of the metal was impaired by the great heat to which it was subjected. But such results as attended the bursting of those tubes demonstrated, that under no circumstances of neglect on the part of the engineer, (or even of malicious intent, supposing that to be possible,) or of accidental derangement in the supply pump, or of the safety valve, &c., is any personal danger, whatever, incurred by the use of boilers made with them.

In the case of a boiler of the ordinary proportions and capacity becoming red hot by the temporary suspension of the supply of water, which is afterwards renewed, the destructive effect of an explosion, as compared with that of the tubular boiler before mentioned, would be in the exact proportion of its increased diameter; hence, the conse-

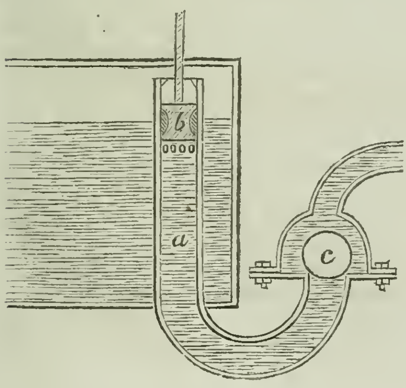
quences, as respects the scalding water, would be as the area of their respective sections, the length being presumed to be the same in both cases. If, therefore, we consider the area of the inch tubes as .785, and estimate the diameter of a common boiler to be 24 inches only, this gives an area of 452.39 inches; consequently, (as will be found upon calculation,) there would be ejected, by an explosion of the latter, 576 times the quantity of water of the tubular boiler, and with a greatly increased momentum. In reply to this, it might be stated that the whole contents of the tubular boiler would be discharged through the fissure opened; but supposing that no provision were made to prevent such a consequence, the jet of water would be nearly like that of a small fountain; whereas, in the large vessel of the common boiler, the accumulated force would produce a sudden and instantaneous irruption of the whole contents, almost in a body, besides projecting great pieces of metal about. It is worthy also of particular notice, that as the comparative safety of boilers is in the inverse ratio of their diameter, the 24 inch boiler must be 24 times as thick as the inch tubular boiler, to sustain the same pressure; that is $4\frac{1}{2}$ inches thick! It is needless to remark, that a boiler of such a thickness would be worse than useless, supposing it practicable to make it.

As the heating of boilers *uniformly* over their surfaces is an object of the utmost importance, your committee will probably think that the plan of heating, patented and adopted by Messrs. Beale and Porter, of London, is worthy of their attentive consideration. It consists in communicating the heat from the furnace through the medium of a surrounding bath, containing a fluid that requires a higher temperature to vapourize it than water; and by varying the composition of the fluid medium, according to the temperature required in the steam, no excess of heat in the engine boiler can take place; nor can any surplus caloric be retained in the bath, as an open pipe proceeds from it to the atmosphere, to carry off whatever vapour may be there produced. The engine boiler is thus protected from any heat that can injure the tenacity of the metal, which need not be of much more substance than is necessary to sustain the working pressure in the boiler. These are the leading advantages set forth by the patentees; but the real merits of the plan, whatever they may be, will, I make no doubt, be duly examined and estimated by your intelligent committee. (An account of Messrs. Beale and Porter's plan for heating high pressure boilers will be found at page 39, vol. V., N. S. of the "Register of Arts and Journal of Patent Inventions.")

One of the fruitful causes of explosions in high pressure steam boilers has been the imperfect action of the force pumps, owing to some derangement of the valves, which they are extremely liable to, on account of the strains to which they are subjected. For this reason the utmost possible simplicity of parts, and the most solid and accurate workmanship, are indispensable. Fine particles of sand insinuating themselves between the surfaces that move in contact very soon render the pumps unserviceable; to prevent which it is highly desirable to use *filtered* water; and the cistern into which the filtered

water is delivered, should, I think, have at least two pipes of communication with the "service pipe," and each of the two pipes should contain a moveable box, in which are properly packed the filtering substances, so that either of them may be renewed at pleasure, without impeding the operation of the other. The cocks and union joints required to render this process convenient, are too obvious to need mentioning. Whilst I am writing, a thought occurs to me, of which possibly something may be made by the ingenious members of your committee; but as I am somewhat dubious of its practicability myself, I put the idea down in the form of a question.—Could not the filtering boxes just mentioned be so arranged as to be rendered *chemically*, as well as mechanically, subservient to the purification of the water,—supposing the filtration to be performed by ascension, and the first, or lowest, stratum of matter, whether solid or fluid, passed through, to be composed of one or more chemical agents, adapted to precipitate the principal matters held in solution by the water? Would not the water thus purified, prevent deposits in the boiler, from whence it is so difficult and troublesome to dislodge it by the ordinary practice? It would surely be much easier to abstract the foreign matter obtained by the first process, in the boxes, than by the last, of evaporation, in the boiler; and I submit that it had better be only partially done, than not at all. The stratum of earthy matter that usually forms and adheres to the bottoms and sides of boilers, not only causes a great loss of heat, or *waste of fuel*, but by interposing a non-conducting substance between the metal and the water, the fire acts very *destructively upon the metal.* Every member of your committee is, I am persuaded, fully aware of these circumstances, and I only introduce a notice of them here, that they may not escape their attention during their important investigation.

With respect to force pumps, so sensible am I of the advantages of simplicity and strength, that I have been led to give a preference to a force pump suggested by Sir James C. Anderson, (in a conversation I had with him on their common defects,) although it works against the pressure of the atmosphere in its up-stroke; of this pump I annex a sketch that I trust will be sufficiently explanatory.

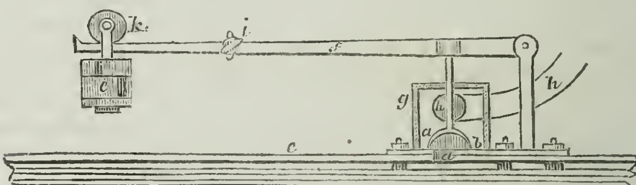


The water enters through the perforations in the tube *a*, when the plunger, *b*, is lifted into the position represented; and when the plunger makes the return stroke, a metallic ball, *c*, is raised, and a quantity of water, equal to that contained in the tube between the perforations and the lowest point of the stroke, is discharged into the boiler. The ball being forced against its seat by the pressure of the steam, prevents

the return of the fluid, and as there is no induction valve, (in the common meaning of the term,) the water cannot be driven back through it, (when out of order,) into the supply cistern, which I have often observed to be the case in common pumps. The power lost by the up-stroke of the pump is not more than a 200th part of that of the engine, which was considered as of less importance than the insuring of a regular supply of water to the boiler. I do not, however, consider it as a perfect machine, and I notice it merely that your committee may give the intention, rather than the plan, their attention.

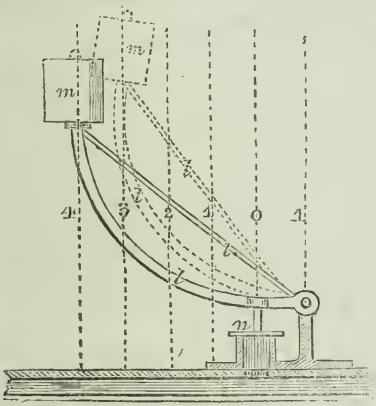
In the application of revolving cocks for feeding high pressure boilers, I consider it as absolutely necessary that the water should be filtered, provided it contains siliceous, or other hard, sandy particles, which are particularly destructive to apparatus of this kind. Revolving cocks were applied by your ingenious countrymen, Mr. Jacob Perkins, and Mr. Joseph Eve; but how far they have succeeded in rendering their action preferable to force pumps, I have not had the opportunity of learning.

With respect to obtaining increased security from safety valves, I have two or three plans to submit to the consideration of your committee; annexed is a sketch of one of them.



At *a* is intended to be represented a metallic cap, inverted, whose edge is to be nicely turned, so that its periphery may lie in a true horizontal plane, upon a flat hard steel plate, *b*, fixed to the top of the boiler, *c;* the hole at *d*, is made much larger than usual, (to allow the steam to escape quicker,) requiring, in consequence, a heavier weight, *e*, or a lever, *f*, of greater effect to keep the cup to its seat; *g* is a box to receive, and *h* a pipe connected thereto, to carry off the steam that escapes from the boiler. At *i* is a sliding loop or stop, which is fixible at pleasure on any part of the lever by means of a finger-and-thumb screw; the intention of this is to limit the range of the weight *e*, which is suspended to the axle of a little wheel, *k*, that runs upon the upper edge of the lever. This part of the apparatus was devised from noticing a recommendation of Mr. Tredgold, in his excellent treatise on the steam engine; that safety valves should be so constructed as to be relieved of a part of their load, when they are raised by the steam. That intelligent writer having, however, omitted to give any plan, I submit the foregoing to the consideration of your committee, as being calculated to attain that object by simple and efficient means.

Although this valve may be found advantageous as applied to land, or fixed, engines, your committee will immediately perceive its ineligibility for steam-boats, the lurching of which would prevent the weight from acting always in the manner desired. To obviate this objection, as applied to steam vessels, I propose to relieve the valve of a portion of its load by another arrangement, which I suggested two or three years ago, in the Register of Arts. This mode is represented in the annexed diagram, in which, in lieu of a *horizontal* lever, I have an *inclined* one, *l*, fixing the weight, *m*, on the upright portion of it; so that when the valve is lifted any given height, by the pressure of the steam, the weight is in effect brought nearer to the fulcrum of the lever; as the forces act perpendicularly, in the manner represented by the dotted lines in the figure, and a lever having the power of 4, is reduced to a power of 3 by a very slight motion of the cover of the valve; the several parts of which differ only from the first, in being an inversion of their order; *n*, in this case, being the steel plate, and *o* a piece of tube, whose edge is accurately turned, so as to touch the plate throughout the line of its periphery. Practical men will decide which plan merits the preference, either as respects the utility, or the facility of construction. There should, of course, be a stop, to limit the range of the lever.



On the same page of the Register wherein I suggested the last mentioned plan, I proposed, as an *additional* security to boilers, that when the mercury should be forced out of the gauge by the undue pressure of the steam, it should be received into a vessel suspended to the power end of a long lever of the first class, whose other end, (near to the fulcrum,) should be made to lift a safety valve from its seat, loaded with a weight greater than that which ejected the mercury from the tube. By this arrangement the valve would be kept open until matters were arranged, and security to persons and machinery be instantly afforded. If the principle of this proposition be approved of by your committee, I need not point out to them the means of carrying it into execution.

As the various suggestions published in the scientific journals of Europe and America, will, of course, undergo the investigation of your committee, it would be supererogatory in me to notice them particularly; but I will just mention that the fusible plug, and Sockl's valve, seem to me to deserve their consideration; and were I not

fearful of rendering my letter too tedious to be read, I could mention various other plans to effect the same object that have occurred to my mind; I will, therefore, here conclude my already too long letter, with expressing the hope that *something, however little*, may be gleaned from it, and my anxious desire that the committee may rather be induced to inquire whether effective boilers cannot be made, which would injure no person or thing, if an explosion should take place, than into modes of preventing the bursting of boilers that scatter death and destruction around them when an explosion occurs.

I am, with great respect,

Your obedient servant,

L. Hebert.

(No. XII.)

Letter from Thos. W. Bakewell, Esq., of Cincinnati, Ohio, in reply to the Circular of the Committee of the Franklin Institute.

Cincinnati, November 1, 1830.

I now enclose a copy of my report to the Secretary of the Treasury, on explosions of steam boilers, which I think contains all the essential information of which I am possessed.

Please receive this as my answer to your communication on that subject, which would have been attended to sooner, but for private engagements, and a latent conviction that the Franklin Institute did not stand in need of my services.

I am,

Very respectfully, yours,

Thos. W. Bakewell.

FOR THE FRANKLIN INSTITUTE.

Copy of a Report to the Secretary of the Treasury.

Sir,—A copy of your letter to Morgan Neville, Esq., of this place, together with a list of interrogatories, relating to the explosions of steam boilers, have been placed in my hands by that gentleman, with a request that I should give such information in reply to them as I may possess.

The interrogatories appear to be addressed more particularly to those who may have been present at an explosion of a steam boiler, and to relate to the circumstances growing out of a disaster of that kind. As I have never been present at an explosion, I shall proceed to the subject apart from the order in which the interrogatories are made. It is desirable that a statement of this nature should be composed of as much of fact, and as little of theory, as possible; and the subject has consequently engrossed my attention for several months, in obtaining such information as might enable me to present a full narration of facts attending many of the explosions on the western waters; but in this I have been disappointed, owing to the confused

and contradictory statements of the parties present. I am, therefore, compelled to rely, in a great measure, on the impression made on my mind, by the several accidents, at the times, respectively, when they occurred, with the consequent risk of my report being biassed by my own peculiar views.

I have been, theoretically and practically, acquainted with the steam engine, both in the making and using of that agent, for nearly twenty years. My experience in its use has consisted chiefly in its application to boats, and I believe no alteration or improvement, either real or pretended, during that period, has escaped my notice.

I have every reason to believe, that most of the explosions of boilers arise from the simple fact of the steam being urged to a density beyond the strength of the boiler, unconnected with the production of hydrogen gas, or any sudden chemical change in the constituent parts of water. But that explosions have occurred, when the steam has not been above the usual working pressure, and under circumstances which cannot be explained, but by admitting the rapid production of some kind of gas, or steam, in quantities too great to be carried off by the safety valve. The *immediate* cause of this last species of explosions, cannot, with certainty, be known. It is, however, generally agreed, that it never takes place unless from a want of a sufficient supply of water, certain parts of the boiler or flues become red hot. The steam, also, in this case, will sometimes be so much heated as to set fire to the deck, or any combustible substance in contact with the boilers; and the steam admitted to the engine in this state, will burn the hempen packing and wood contiguous to the engine. To the above effects I have been an eye witness, but no explosion ensued. And here I would observe, that although there exists a difference of opinion, as to the proximate cause of explosion in a boiler thus circumstanced, it is generally agreed, that to inject water, before the fire shall have been extinguished a sufficient length of time for the boiler to cool, is the most dangerous step that can be taken.

The two opinions as to the cause of explosions, by injecting additional water, or by agitating that already in the boiler, in this heated state, are first, the oxidation of the hot iron, and the consequent disengagement of hydrogen gas, which, by its subsequent combustion, creates the explosion of the boiler. The other opinion is, that the rapid production of steam, is of itself sufficient to account for the effect, and that if hydrogen gas be generated, it acts, by its expansive force, as a gas, in addition to the steam; and in corroboration of this view of the case, it is alleged, that copper boilers have exploded under circumstances which might well have been attributed to the combustion of hydrogen gas, had not the material of which they were made precluded the idea.

The only case on the western waters which we are compelled to refer to one, or other, of the last two mentioned causes, is that of the steam-boat Grampus, whose boilers, six in number, cylindrical, 38 inches diameter, with two 14 inch flues in each, exploded simultaneously, about daylight in the morning; and after it had been dis-

covered that they contained very little water, and a plentiful supply was suddenly thrown in. It is said, but not well established, that a smoke, and smell of burning, was perceived before the explosion.

Several explosions have taken place by suffering earthy sediment to accumulate on the bottom of the boiler. This sediment will, in time, become heated, or baked, to dryness, and the contiguous metal attain a red heat; when thus weakened the metal is incapable of sustaining the ordinary pressure of steam. The late accident on board the steam-boat Caledonia, was from this cause. But the most frequent cause of explosion has been from the direct pressure of the steam, without recurring to others, more remote or occult.

Owing to explosions having taken place after the engine has made a few strokes, the idea has obtained, that the steam was not at the highest point at the instant of explosion. Moreover, it is contended that explosions have taken place at starting, when the steam was certainly not higher than it had frequently been.

It will be observed, however, that when a boat is *about to start*, it is usual to prevent the further escape of steam through the safety valve, and to urge the fires; and that owing to the gradual and slow motion of the engine for some time, (say half a minute,) after starting, the steam is generating faster in the boiler than is demanded by the engine, and that the point of time, when the steam is at the highest pitch, is more frequently over half a minute, than under that period of time.

It is known, also, that a boiler, or iron shaft, or other piece of machinery, will give way by a continued strain, which strain shall be less in degree than would be sustained for a short time without injury; and that it by no means follows, when a boiler explodes by excess of steam, that it never had previously been subjected to an equal pressure.

I am not aware of any instance where two successive and distinct explosive efforts have been detected, as alluded to in your last query. This, however, was stated to have been the fact in the explosion at Bowen's mill, at Pittsburg, in 1821. I had satisfied myself by personal investigation at Pittsburg, that this report was erroneous, and in a description of that disaster, lately received from Mr. Bowen, the idea is again refuted. The boiler gave way at the bottom, over the fire, and was known to contain sufficient earthy matter, to warrant the conclusion that the baked sediment was the immediate cause of the explosion. The usual source for the supply of water, had been interrupted, and the boiler supplied, for three days previous, with water from a muddy well.

An explosion took place, about eighteen months ago, in M'Mickle's mill at Pittsburg, under circumstances so similar to that at Bowen's, that it is fair to attribute them both to similar causes. It was known in both the above cases that there was no deficiency of water. By the aid of a few figures, (not necessary to introduce here,) it would be easy to show that the steam alone was much more than adequate to the effect, or the projecting of the boilers from the mills.

As an instance of the difficulty of arriving at the truth, in occurrences of this kind, allow me to state, that in the year 1827, the steam-boat Union, Capt. Clark, when a few miles below this place, burst off one of the cast iron ends of her cylindrical boilers, 36 inches diameter. The after end, which flew off, passed, together with water and steam, through the cabin, tearing down all the light partitions which intervened, and laying open the cabin by parting its sides from the deck above. The boiler, by the unbalanced pressure, or reaction, after the end flew off, was projected over the bows of the boat into the river.

The boat was shoving off from the shore at the time, and about to start, but as far as I can learn, the wheels had not made a revolution.

I saw the captain and some of the crew soon after the accident, who assured me there was plenty of water, for he, (the captain,) saw the gauge cocks tried two minutes before the explosion. But at a subsequent period, and after the captain had conversed with some of those who contend that a boiler cannot burst with "fair play," as it is termed, he became of the opinion, that the cause was a deficiency of water, and the flue being red hot; and did not doubt of its being collapsed, and that the formation and combustion of inflammable gas, or some other hidden and uncontrollable circumstance, produced the explosion.

The history of the case rested on these grounds until the boiler was recovered from the river, when it was seen that the flue and interior of the boiler were perfect, and exhibited no signs of having been heated red hot. A thin whitish coating of earthy (probably calcareous,) matter was on the upper part of the flue, which some, at first sight, supposed to indicate its having been heated; but this appearance is observable on all flues after the water is drawn off from the boilers, at the same low stage of the river. The flue in this boiler did not pass through the end which was forced off, but turned down by an elbow, short of the end, to receive the heated air and smoke from the furnace below.

The steam was usually worked at about 80 lbs. to the inch, and at the time of the accident the Union was in contest with another boat.

The principal reason of explosions having been more frequent of late, on the western waters, than formerly, is simply because the engineers work the steam higher; and this they are enabled to do with the same boilers by cutting off the steam shorter, not only with cams suited to that end, but by "pinching" the steam at the throttle valve.

This mode of proceeding, together with the prevailing notion, as before stated, that boilers do not, or will not, burst by "fair play," that is, by the pressure of the steam alone, with plenty of water, has been the main source of the recent disasters.

The success which has attended the British act of parliament, predicated on the most direct and obvious view of the case, to wit: that boilers burst because the steam is too strong, or the boiler too

weak, is deserving of our serious consideration. That act provides that every boiler shall be tried by hydrostatic pressure to bear three times the strain, which shall be indicated by an extra certified safety valve.

The details of the examination inducing this act may be found in "Partington, on the Steam Engine," London Ed. of 1822. I conceive that this very severe test secures the boilers from explosion, not only from the pressure of the steam *with* a sufficient supply of water, but in all ordinary cases *without* a proper supply; for with this required extra strength, the flues of most boilers would sustain the working pressure at a red heat, and the boilers of the English boats are exempt from one of the sources of accidents with us, viz. the gradual wasting and weakening of that part of the bottom of the boiler, which in many of our boats is exposed to the action of the fire, and kept in a red hot state by baked and dry earthy sediment over it.

The bottoms of their boilers, where the sediment settles in injurious quantities, are not exposed to the action of the fire any more than those of most of our eastern boats; and a very slight test of strength, beyond that allowed by the safety valve of the "Chief Justice Marshal," would have shown that the lower part of her boilers, or large flues, was insufficient to stand the fair pressure of the steam, though not exposed to the fire.

If a test, equally severe with that of the British act, were required in this country, nearly all our boats, both eastern and western, would be rendered useless; and it therefore remains to be considered, to what degree it may be imposed, without being oppressive, in the present condition of our steam navigation.

Permit me to suggest, that all boilers of boats, used for the conveyance of passengers, be proven at least once in twelve months by hydrostatic pressure, to be capable of sustaining *double* the pressure that should be indicated by an extra safety valve; which said extra safety valve should be under the sole control of the master of the vessel, and he be under bond and oath that no greater pressure of steam should ever be carried than shown by the lifting of said extra safety valve. That surveyors be appointed at convenient ports to see to the proper and faithful carrying into effect of this measure, who should grant their certificates accordingly.

Every boat has, or may have, at a small expense, the means within herself of applying this required test, by attaching a temporary lever to her forcing pump, to be worked by hand, or a small one provided for the purpose.

This test might be relied on for preventing explosions from the usual cause, (excess of steam,) and also, in most cases, where the accident takes place from the metal being weakened by heating.

I know of no legislative enactment that can provide against a deficiency of water, or an accumulation of mud, or saline deposit, in the boiler.

The contrivance called a "tell-tale," designed to give notice when the water gets too low, and sometimes made self-acting, so as to supply the boiler, is with reason objected to by practical men as uncer-

tain in its own operation, and tending to lull the engineer into carelessness and false security, and whenever the boat should have motion from a sea, would be utterly useless. It is true that the constant turning of the gauge cocks is an irksome office, and it is apt, on this account, to be neglected. If some more easy and agreeable mode could be adopted, of making the engine tender an *eye witness* to the height of the water in the boiler, it would go far towards removing danger from this source. Tubes of glass have been tried in Pittsburg and in this place, the lower ends of which communicated with the water, and the upper ends with the steam, which answered the purpose completely so long as the tubes remained entire; but the manufacturers have not been able to anneal any tubes sufficiently to stand long in that situation.

I am informed that glass in the form of tubes when of the required thickness to sustain the mechanical pressure to which they are exposed, will not stand the inequalities of temperature at the inner and outer surfaces, but that there is no difficulty in making a *plate* of glass stand; and I have, in consequence, ordered some plates for this purpose, which I intend to insert in the sides of a square cast iron pipe, attached to the end or side of the boiler.

Of High and Low Pressure Engines.

The comparative merits of these two kinds of engines, both as regards safety and efficiency, have become somewhat of a party question, and great caution is required in receiving the opinions of any on this point. It may, therefore, be expected that I should be prejudiced in favour of the one or the other, and there is no reason to hope for impartiality in the present notice of them, except so far as the opinions of others, (with respect to myself,) and the using of both kinds of engines, may give grounds for supposed impartiality. Both these circumstances exist in favour of an unprejudiced report of them.

The proportional extra strength of *all* boilers, over that of the steam intended to be carried, may generally be assumed as equal, and the liability to explode as equal, but the disastrous consequences in the event of an explosion may be estimated to be in proportion to the height or strength of the steam at the time of explosion. Hence it must be inferred that the balance of safety is on the side of the low pressure engine, and I believe the experience of the last ten years will bear out this conclusion; not so much by the greater number of accidents with high pressure engines, as by the greater destruction when they do happen.

To engineers "high and low pressure" are indefinite terms. Engines which condense the steam, (as distinguished from those which suffer it to escape in the air,) work steam at all the various pressures from 5 lbs. to 100 lbs., on the square inch, and as good a vacuum may be obtained in the one case as in the other, contrary to popular opinion, and that expressed in several works on the subject. The same quantity of caloric, (and of steam by weight,) will pass to, and be overcome by, the condensing apparatus, with the same furnace

and boilers, whether the steam operate through a large cylinder at five pounds, or through a small one at 100 lbs. to the inch; but the *nett* gain by the vacuum, on every square inch of the piston, (say 10 lbs.) is the same in both, so that the smaller the cylinder, and the higher the steam worked, the less does the vacuum become an object, and is consequently, in most cases, relinquished altogether, and then the engine is called "high pressure."

Very respectfully, &c.

(Signed,) THOS. W. BAKEWELL.

Cincinnati, 1*st November*, 1830.

(No. XIII.*)

Cincinnati, January 19, 1831.

DEAR SIR,—Your favour of 3d inst. is to hand. The only additional experiment to those enumerated, which I think desirable, is in connexion with No. 7. This experiment; (No. 7,) is to "ascertain whether any other gases than steam are produced in the boiler;" but it is of the greatest importance to know whether any other gases thus supposed to be produced will explode, or ignite, in the boiler producing them.

If a boiler be filled with water, (or nearly so,) and the steam suffered to escape at the top, as is the case with an engine boiler, it may be presumed that all the atmospheric air is expelled from the boiler, and the water, before it should become so low as to expose the hot metallic surface to the steam. If the water, (or steam,) be decomposed by the heated metal, and the combustion of the hydrogen gas can, at any subsequent period, take place, while in the boiler, what prevents the combustion in small portions as soon as it is formed, and while in contact with the heated metal, (thus preventing an accumulation of it;) or what degree of accumulation should determine an explosion? The opinion I hazard on this point is, that if hydrogen gas be produced in a boiler, *circumstanced as above*, it would only be similar to a gas generator, and that the gas would not ignite until it had access to the atmosphere, and that the gas issuing from an orifice might ignite, but would not produce the combustion of that within. I know it has been stated, (hypothetically,) that a part only of the oxygen is taken by the metal, and a part left in a state of mixture with the hydrogen, which, *in due time*, causes the explosion.

I am, very respectfully,

Yours,

THOS. W. BAKEWELL.

[TO BE CONTINUED.]

* In reply to a letter stating the course of experiments which the Committee of the Institute were about to undertake.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Observations on the importance of Meteorological Observations, particularly as regards the Dew Point: and also on the several fluctuations of the Barometer, by James P. Espy, *Professor of Languages.*

In a previous essay I endeavoured to awaken the attention of scientific men to the department of meteorology. I ask again why is it that this highly interesting and useful branch of human knowledge makes such slow advances, whilst almost every other department of physical science is receiving important additions every year?

The labours of chemists have made us acquainted with the elements of the atmosphere which surrounds us, and the illustrious philosopher of Manchester, has enabled us at any moment, with the simple aid of a common thermometer, and a tumbler of cold water, to tell with absolute certainty, not only the number of grains* of aqueous vapour contained in a cubic foot of air, but the whole weight of the aqueous atmosphere to its very surface; and yet with this powerful instrument in our hands, meteorology languishes; we cannot yet predict the weather forty-eight hours in advance—the very cause of rain is unknown—and the "*Dew Point*" is published in only one journal in the United States.

Let learned and scientific societies answer to themselves and to the interests of mankind for this egregious neglect. Do philosophers think that no more discoveries can be made on this subject? and that the weather never can be predicted?

If indeed we were obliged to depend upon those imperfect hygrometers in use before Dalton's discovery, there would be some reason to despair of ever being able to predict the weather; but when we consider that the quantity of vapour in the atmosphere is the only constituent which changes its proportion, varying from $\frac{10}{1000}$ of the whole atmosphere when the dew point is 13 Fah. to $\frac{88}{1000}$ when the dew point is 76, (indeed the dew point sometimes sinks lower than 13 Fah. but I have never seen it higher in Philadelphia than 76,) and when we consider that the weather depends so much upon the quantity of vapour in the atmosphere, it becomes highly probable, that cotemporaneous observations, made on the quantity of vapour alone, in different parts of our widely extended country, would solve the problem of the weather, which has hitherto eluded the researches of the most patient observers.

My object in this communication is to endeavour to awaken in your readers an interest in this subject by communicating a few facts of my own observation, and correcting some prevailing errors which vitiate all systems founded upon them.

It is, I believe, universally admitted, that whenever the air over a particular region begins to be expanded by heat more rapidly than the air of surrounding regions, a flow of air immediately takes place towards the hotter part.† Now this is not the fact—for the

* See table at the end of this essay.

† See review of Mr. Daniell, American Quarterly, for March, 1828.

air, in becoming hotter, increases in elasticity, and presses harder in all directions than it did before, upwards, and downwards, and laterally; and moves the surrounding air outwards as well as upwards until the equilibrium is restored. This increased elasticity, or pressure of the air, is indicated by the barometer after sunrise in all climates, particularly in the torrid zone, where its semidiurnal fluctuations are so regular that its point of elevation almost indicates the hour of the day. It rises regularly from sunrise till 10 o'clock, about which time the heat is increasing most rapidly; it then falls till five, about which time the rapidity of refrigeration is the greatest, and, of course, the pressure least; after which it rises by reciprocation till about ten, and then falls till sunrise, for the same reason. These fluctuations may be detected in this latitude by taking the mean of a great many observations, recorded at 9 or 10 A. M., and 5 P. M. In the city of Philadelphia, 45 feet above the sea, very careful observations have been made on the barometer since the 1st of April of the present year.

The barometric mean for April, between 9 and 10 o'clock, A. M. was 30.026 inches, and at 5 P. M. 29.968. For May, at the same hours, 30.04 inches, and 30.00 inches. For June, at the same hours, it was 30.145 and 30.111, and for July 30.10 and 30.06. For each of these months, then, the barometer, at a mean, has been about four one-hundredths of an inch higher between 9 and 10 o'clock in the morning, than at 5 in the afternoon. No doubt the fluctuations by reciprocation could be detected by observing the hours in which they take place. This I intend to do, before you receive my next communication.

The general principle which I wish to state as the cause of the semidiurnal fluctuations of the barometer, is that a sudden increase of temperature in the air will cause an increased pressure on the barometer, and vice versa, a sudden diminution of temperature will cause a fall of the barometer; but it must be understood that these effects on the barometer will be observed at the moment of the change of temperature, before the quantity of air over the observer has time to be increased or diminished by flowing *on* in the upper regions in the case of refrigeration below, or flowing *off*, in case of expansion, by increased heat.

To illustrate my idea by an example: Suppose at sunrise the temperature of the air over the whole island of Great Britain to be 32° Fah., and suppose the temperature to increase to 42 by 10 o'clock, of all the air covering the island, to the height of 96 feet. Now, as the experiments of many philosophers prove that the bulk of air, at the temperature of 32, is increased $\frac{1}{480}$ for every degree of Fah., therefore, by an increase of 10 degrees, this lower stratum of air, 96 feet high, will be increased in bulk $\frac{1}{48}$ of the whole; and if the air around Great Britain, to a great extent, expands as fast as the air over the island, then will the pressure of air inwards, from the ocean to the island, be equal to the pressure outwards, and the whole atmosphere over the island will be thrust upwards 2 feet by the expansion of the lower stratum of air 96 feet thick.

But if the lower stratum of air over the ocean does not increase in

temperature, after sunrise, as fast as that over land, then will the effect of some part of the greater expansion over land be, to thrust the air out laterally from the land to the ocean; but in either case, the barometer will rise while this process is going on. This rise, moreover, will be in proportion to the rapidity of the increase of temperature; for if this lower stratum of air could be supposed to increase in temperature instantly 10 degrees, then would there be a rise of the barometer for a moment nearly $\frac{1}{48}$ of 30 inches; for the inertia of the air itself, would, for the first moment after the increase of temperature, afford nearly the same resistance to the motion of expansion, as if it were confined by an inexpansible vessel.

A remarkable proof of the great resistance inertia makes to sudden motion, was given some years ago in Silliman's Journal. A quantity of fulminating powder lying on a table and covered with a bell glass, accidentally exploded—the bell glass was merely lifted up a short distance, and broke in falling, but a hole was made through the table. The inertia of the powder, together with the atmospheric air, was so great as to react on the table with such force as to pierce a hole through it.

If I have been so fortunate as to render myself intelligible in showing the cause of the rise in the barometer by an increase of heat, I flatter myself that any one may easily perceive the cause of depression in the afternoon, and the two remaining fluctuations by reciprocation during the night, without any further illustration from me. I will, however, before I pass to another subject, answer one objection which may be proposed to the explanation here given. It may be asked if increase of heat in the air is the cause of a rise of the barometer, why does not the barometer continue to rise till the hottest part of the day? I answer, this would be the case if the air were confined in an inextensible vessel. This, however, is not the case, but the whole column of atmosphere above the expanded part, is raised, and the greatest resistance it makes to raising is at the moment when it is thrust upwards with the greatest velocity; that is, not when the heat is greatest, but when it is most rapidly increasing, which is known to be about 9 or 10 o'clock; about half way between the time when it begins to increase, at sunrise, and ceases to increase, at the hottest part of the day.

If I have been successful in establishing my own theory of the semi-diurnal oscillations of the barometer, I need not stop to refute Professor Leslie's theory of the sea breezes being the cause, though it is known that these oscillations take place in the midst of the great Pacific ocean. Nor Mr. Daniell's theory, which makes these oscillations depend upon the polar currents, and whose theory makes it necessary that on the same longitude, even at the autumnal and vernal equinox, the barometer should fall in high latitudes at the same moment it rises in low. Nor M. Ramond's theory, though quoted with approbation by M. P. E. Morin, which makes these oscillations depend on the increased and diminished quantity of air over our heads; that is, that more than a mean quantity is over our heads at 9, A. M. and less than a mean quantity at 5, P. M., which is caused by the surface of the atmosphere being elevated above its mean

height at noon, and depressed below its mean height at midnight, and of course at noon it runs off, and at midnight it runs on, from the east and the west of those longitudes.

It appears at first sight that some effect should be anticipated from this principle. It is worth a moment's reflection: let us subject it to actual calculation.

It is known that at the height of a few hundred feet, the air changes very little in temperature during 24 hours when it is clear, for the rays of the sun pass through clear air without heating it much, and it is chiefly by contact with the surface of the earth that the lower stratum of air becomes heated during the day, and cooled during the night. Even in this lower stratum, the difference of temperature between day and night does not often exceed sixteen degrees. Let us, however, put an extreme case, and suppose that the difference of temperature of the lower stratum of air 500 feet high is 20 degrees; the expansion due to this elevation of temperature in the day above the night, is about 40 feet. If, now, we suppose the whole of the atmosphere above this to vary in temperature daily one degree, the elevation of the atmospheric column due to this increase of temperature in the day, will be $\frac{1}{480}$ of the whole, if we suppose the mean temperature of the air to be 32. Now $\frac{1}{480}$ of 40 miles, the height of the atmosphere, is 440 feet; add to this 40 feet, the expansion of the lower stratum of air, as above, and the whole elevation of the atmosphere, at the hottest part of the day, above the coolest, is 480 feet. Now let us see with what velocity the upper stratum of air will move from the greatest elevation at noon, towards the greatest depression at sunrise. We have then an inclined plane 480 feet high, one quarter of the circumference of the atmosphere in length; that is, about 33,000,000 feet, or 68,800 times its height. Now, by mechanics, a body free from friction would run down such an inclined plane $\frac{1}{68800}$ part of $16\frac{1}{12}$ feet in one second of time, and as the spaces passed over down inclined planes are as the squares of the times, in six hours, even if the height of this inclined plane did not diminish, which it does, the space descended along the plane would only be 109175 feet, which is about $\frac{1}{302}$ of the whole elevation; that is about 19 inches of atmospheric air at a mean density; a quantity too small to be appreciated in the barometric fluctuations. Many other objections might be brought forward against this theory of M. Ramond, but I forbear to state them now.

The next prevailing error I shall notice is, that "mountains attract clouds." See Edinburgh Encyclopedia, article Hygrometry; and Library of Useful Knowledge, article Physical Geography. Now that clouds frequently appear near the tops, and on the sides of mountains, when they appear no where else, is a well known fact. Let us see how this can be accounted for on established principles, without supposing any mysterious attraction for which no reason has ever been assigned.

Mr. Ivory says, "if a mass of air were suddenly reduced to half its bulk, the heat evolved would be 90°"—consequently if it were suddenly expanded to twice the space, it would lose 90° of tempera-

ture. (Phil. Mag. Feb. 1827.) Suppose, now, to put an extreme case, a current of air at the temperature of ninety, completely saturated with moisture—that is, having its dew point at 90°, should meet a mountain, and blow up its side; by ascending, it would expand, and by expanding it would become colder one degree for every $\frac{1}{90}$th of expansion; let us see how much vapour would be condensed from a given quantity of air when it has ascended so high as to occupy double the space, and when the temperature is zero. By the table given at the end of this article, a cubic inch of air, saturated with vapour, at the temperature of 90°, contains .00836386 grains of aqueous vapour, and at the temperature of zero, 2 cubic inches, saturated, contain .00089914 grains. Now the former quantity is more than nine times the latter; therefore more than $\frac{8}{9}$ of the aqueous vapour which the air contained at the foot of the hill, will be deposited in rain before it rises so high as to occupy double the space. This calculation is on the supposition that the ascent is so rapid that it takes a temperature due to sudden expansion. If it ascends very gradually it will be shown presently that its temperature will not sink so low by about 18 degrees, for the mean temperature of the air at that height is about 72 degrees, and not 90° lower than that at the surface of the earth. But even at this temperature the quantity of moisture could not be quite one-fifth in the upper station of what it is in the lower. Thus have I demonstrated that nothing is necessary to produce clouds and rain on the sides of mountains, but an ascending current, whose dew point, at the base, is near the temperature of the air. That such a current upward actually takes place, every one who has been on the side of a mountain many times can testify, for he has felt the air blow upwards.

The principle here developed may also serve to account for the fact that the quantity of rain on the sides of mountains is greater than on the plain below. For notwithstanding M. Leslie has given currency to an opinion that more rain falls in low situations than high, the reverse is a well established fact. Indeed the whole economy of nature requires it, and we might be pretty certain of the fact á priori.

"In the neighbourhood of Kinfaun's castle," (says the Edinburgh Encyclopædia, article Meteorology,) "a rain guage is placed on the summit of a hill, 600 feet above the level of the sea, and another in a garden at the base of the hill, about 20 feet above the sea. The following is the mean result of the two for five years: from 1814 till 1818, hill guage $38\frac{84}{100}$ inches, garden guage $25\frac{66}{100}$ inches.

"No part of the above difference can be ascribed to any thing in the situation of the garden guage, but its being lower down. It is fully exposed to the rain, and as the best proof of this, its average amount for six years is about two inches greater than that of another, situated in an open country, at the distance of about a mile."

Indeed there is strong reason to believe that even at a distance from mountains there is more rain falls at some distance above the surface than at the surface itself. This is certainly the case sometimes, for I have known a large shower to take place when the lower

stratum of air was more than 20 degrees above the dew point, and consequently the drops of rain falling through this heated air would certainly evaporate some; and as an absolute proof of this, I have known the dew point to rise two degrees during a shower of half an hour.

It is true, the reverse of this sometimes takes place, for the drops of rain coming from a great height enter the region below with a temperature greatly below the dew point, and of course increase in size; whether this latter effect is equal to the former cannot be determined from theory in its present imperfect state.

However this may be, it is certain it frequently rains above when it does not rain below. In the middle of every dense cloud there is a considerable rain. The upper part of the cloud is in air cold enough to condense the vapour, and the lower is in air warm enough to evaporate it, and the middle frequently consists of pretty large drops of rain, which fall with velocity enough to give an impulse to the air, which is felt at the surface of the earth, for the cloud, (that is, the rain,) is the cause of the accompanying wind, and not the wind of the rain.

In meteorology it is not always easy to distinguish of two concomitant phenomena, which is the cause and which the effect. For example, it has, universally, so far as I know, been believed that the very great flood of rain which frequently succeeds immediately, or accompanies, a very sharp clap of thunder, is caused in some way by electricity. In Walsh's Notices of Brazil, vol. ii. p. 92, a thunder storm is explained on this supposition.

"It becomes quite dark in mid-day, except when some lurid blaze enveloped us, which was accompanied by a sheet of water, which fell on us like a cataract, and almost beat us to the ground. The explosion of sound immediately followed the flash.—If I could have divested myself of the alarm which the immediate proximity of such awful danger excited, I should have been delighted to contemplate the chemistry of nature on her grand scale. I remember with what pleasure I had seen Sir H. Davy produce water from the combustion of hydrogen and oxygen. Here it was generated in an instant from the same cause, and I was standing in the midst of the combustion, and admitted, as it were, into the very interior of nature's great laboratory."

Again, in the article Meteorology, mentioned above, "That electricity is a frequent and powerful agent in the formation of rain is extremely probable. The well known fact that the rain which accompanies a thunder storm is more copious than in any other circumstances, is evidence sufficient that it is frequently modified or increased by the influence of electricity."

I once thought with the writer of this last quotation; but when I consider that the immense flood of rain which frequently accompanies thunder succeeds it so immediately that the drops could not have time to fall many feet, much less from the clouds; and that Mr. Walsh's idea cannot be correct, for there are no hydrogen and oxygen uncombined in the atmosphere to produce combustion; and if

there were, the result would be aqueous vapour, not water; I was compelled to look for some other explanation of this phenomena. The true solution of the difficulty, I think, will be found in considering the rain as the cause, and the lightning as the effect.

When a large quantity of rain is discharged from the clouds at once, and when the lower drops approximate very near to the earth, whilst the upper drops reach the clouds, they form an immense *discharger* for nature's great battery, and the lightning is discharged just as the lower drops of this sudden deluge are about to fall to the earth; but as the great mass of rain generally succeeds the electrical discharge, it is not wonderful that the cause should have been considered the effect, and the effect the cause.

The utility of lightning in the economy of nature, is yet to be discovered. That it, and the means of predicting the state of the weather will be discovered, at no very distant day, I have little doubt. In the mean time, nature must be patiently interrogated, and faithful answers will certainly be returned.

I come now to speak of an error of great magnitude, and of universal prevalence, I believe, in this country. It was first conceived by Professor Dwight, and it has lately been assumed by Professor Mitchell as the very foundation of a laborious theory, in which he endeavours to explain many meteorological phenomena, particularly why the mean annual temperature of our continent east of the Rocky mountains, is lower than that of Europe on the same latitude. The error I allude to is, that the air in large quantities sometimes descends from the upper regions to the lower, and brings with it a great and sudden depression of the thermometer; and that universally when the wind blows across mountains, in descending down the side to the leeward, it brings down cold weather with it. It seems to be taken for granted by these theorists, that because the air is at a lower temperature in the higher regions than in the lower, if this upper air were brought down by any means, it would therefore be cold; forgetting another principle with which they are familiar, that air suddenly condensed by pressure becomes hotter. Now whether a portion of air suddenly brought down from the upper regions and subjected to a greater atmospheric pressure below, would be hotter or colder than the air at the surface of the earth, can only be ascertained by observation and experiment.

In the July number of the Philosophical Magazine, 1825, Mr. Ivory says, that Mr. Ramond had collected forty-two different measurements for the purpose of ascertaining the decrease of temperature in ascending the atmosphere. The greatest altitude in these is Gay Lussac's ascent, nearly 7600 yards; and in this particular case the height for one degree Fah. is 105 yards. The average of the whole, however, is 100 yards to a degree.

In the ascent of Gay Lussac, the thermometer fell from 55.4° to 17.1° below zero, that is 72.5° Fah.; at the same time the elasticity or weight of the air was reduced from 1 to 0.432, and the density to one-half very exactly. Now it is known by experiment, as was mentioned above, that air suddenly reduced by pressure to one-half the space

acquires 90° of temperature; that is, if Gay Lussac could have transported some of the air from the height to which he ascended where the density was only one-half to the surface of the earth, where its density would be doubled, its temperature, if it neither lost nor acquired caloric, would be increased 90°, and so be 17.5° warmer than the air at the surface of the earth. In like manner it may be shown that if air be brought down from any other elevation, its increasing density will constantly keep its temperature above that of the air into which it is successively introduced, and the greater the elevation from which it is brought, the higher will be the temperature above the stationary air below.

Indeed it is easy to show that if the reverse of this is the fact, the equilibrium of the atmosphere could not be preserved; for if a current once commenced downwards, it would always continue to flow; for the descending column of air being, by supposition, colder than the surrounding air, would always be heavier, and it would consequently rush downwards from above, and outwards at the base, with a fury proportional to the supposed difference of temperature. Now as no such vortex exists in the atmosphere, we might, with great certainty, infer, á priori, that the air in the upper regions is not colder than at the surface of the earth it would become by being suddenly expanded to the same degree of rarefaction. It is known that a pound of steam, if the space it occupies is saturated, contains the same quantity of caloric at all temperatures. From this, Mr. Dalton inferred that every pound of atmospheric air contained the same quantity of caloric at all elevations; in this, however, the philosopher of Manchester was wrong, as was afterwards demonstrated by Mr. Ivory. Indeed it follows from the example given above, that air, rarified suddenly at the earth's surface, is only one degree in four colder than air of the same elasticity in the atmosphere, for 90 is nearly one-fourth greater than 72.5. Nor is it at all wouderful that the air in the upper parts of the atmosphere should contain more caloric to the pound, than it does below, for there the vapour is condensed into water to form clouds and drops of rain, and every portion of vapour which is condensed into water, gives out nearly 1000 degrees of caloric. (See Ure's Chem. Dictionary, article Caloric.) Perhaps it may appear inconsistent to some that the vapour should condense among strata of air which contains more caloric than an equal weight of air near the surface of the earth. But if they will recollect, that the vaporic atmosphere is more elastic than atmospheric air, and that, consequently, its density in ascending does not diminish as rapidly as that of atmospheric air, they will see how it should condense above rather than below. For more particular information on this point see Daniell's Meteorological Essays, a work invaluable to the student of this most interesting science.

In fine, on this point, I think it very clear that the air coming across the Rocky mountains cannot, on any theory, cause a diminution of temperature on the eastern side, for if the air becomes very cold by ascending on the western side, for the same reason it be-

comes very warm again by descending on the eastern. Indeed, on the principle demonstrated above, the air in ascending a mountain becomes colder at the top than air of equal elevation over a plane, and yet, in descending on the other side, it must manifestly recover its original temperature when it has descended to the same level.

Before I proceed to another subject, I will answer one more objection which might be urged against my position, that air brought from any height, however great, is not colder than the air into which it is introduced below, but warmer one degree in four. It is known that a summer's shower always cools the air, particularly if accompanied by wind, which is evidently caused by the downward motion of the air in the midst of the shower, for the wind blows outwards from the shower below in all directions, just as it should do on supposition of its descent in the middle of the shower. I answer, this is undoubtedly true, but the descending of the air is not the cause of the cold, but the cold is, in part, the cause of the descending of the air. I say in part, for it is partly caused by the impulse of the drops of rain in falling through the air. But it may be asked, how is the air cooled? The answer is easy. By the rain itself descending from a great height, in many cases much beyond the region of congelation, which in this climate is not much above two miles and a fifth. Being poured out in this cold region it descends into the warm air below, cools it down in some degree, and in cooling it dissipates into vapour: meantime another and another flood succeeds, until finally the air is cooled down almost to the dew point, when the rain which descends from above now reaches the earth, and the whole column of air under the cloud being now cooled many degrees lower than the surrounding air, descends, and in descending spreads out below, and produces a wind in all directions from the rain. It is not, however, to be supposed, that the wind at the surface of the earth will extend to any great distance from the shower; for the great condensation of the column of air under the cloud, and the still greater condensation of vapour in the cloud, will cause the air from the surrounding regions to flow towards the cloud; and this any person who attentively observes the phenomena which attend a summer's shower, may readily discover.

Do mountains then, it may be asked, produce no effect on climate? Yes, certainly; not so much by changing the temperature of the air crossing them, as by causing a diminished flow of air, especially near the surface of the earth, from one climate to another. The Rocky mountains for instance, by the winds which blow from the great Pacific ocean, cause the summers on the eastern side to be warmer, and the winters to be colder, than they would be, if there were no obstacle presented to these prevalent west winds; for it is too well known to need discussion here, that sea breezes render climates subjected to them, more temperate, both in summer and winter. This accounts in the most simple and satisfactory manner, for the mildness of the winters, and the coolness of the summers, on the western coast of Europe, in high latitudes, where the predominating winds

are from the west, when compared to the severity of both winters and summers on the eastern coast of North America on the same latitudes. The ocean being warmer in winter, and cooler in summer, than the continents on the same latitudes, the wind which blows over the Atlantic, when it reaches the shores of Europe, must partake of this mild temperature.

A question here naturally presents itself. Is the cooling effect of the air from the ocean on the coast of Europe as great in the summer, as the warming effect in winter? Or, in other words, is the mean temperature of the year the same in Europe and America? Mr. Leslie answered this question in the affirmative. But it is now ascertained by actual observation that Quebec is as cold as Stockholm, though the latter is nearly 13 degrees of latitude further north; and that Cambridge, U. S., has the same mean annual temperature of London, though the latter is 9 degrees further north. If we examine why the sea changes its temperature for the different seasons less than the land, we shall discover that the difference between its temperature and that of the land is much greater in winter than in summer; and, consequently, the heating effect of the air which blows from it on the land in the winter, will be much greater than the cooling effect in summer.

The reason why the sea is colder than the land in summer is, because the rays of the sun penetrate and heat the water to the depth of many feet, whilst on land their influence is spent in warming the very surface. Some effect also may be produced by the mixing of the water by agitation, and also by evaporation, which may be supposed to be greater at sea than on land. But the whole amount in summer cannot be near so great as in winter, for in the autumn, as soon as the surface of the water begins to be cooled down in the slightest degree, it sinks, by its greater specific gravity, and the warmer water below takes its place, until the whole mass of water, to the very bottom, is cooled; and from this principle alone, the temperature of the sea at the surface will be preserved many degrees above that of land during winter. But this is not all; the specific gravity of the colder sea water at the north being greater than that of the water at the south, will, by hydrostatic pressure, cause a current of water at the bottom of the ocean, from the north towards the south, which must cause a current in the contrary direction at the surface, and all these effects, aided by the Gulf Stream, will keep the temperature of the sea, in high latitudes, many degrees higher than the land. Nor is this merely hypothesis. Baron Humbolt says he has found the temperature of the sea at great depths, even in the torrid zone, as low as 45 Fah. Now this can only be accounted for by supposing an under current from high to low latitudes. For this stratum of cold water lies between a temperature of 80° at the surface, and a temperature below increasing about one degree for every 50 feet of descent, as is abundantly proved by the regularly increasing temperature of mines in their descent. See Cordier on Temperature, &c.

Now if this cold water at the bottom of the ocean were not sup-

plied with water from high latitudes, it certainly would acquire the same temperature as that at the surface.

In the month of December, Jonathan Williams, in passing from the United States to Great Britain, found the temperature of the Gulf Stream 70°, the open ocean 60°, and near the coast of England 48. If we suppose the mean temperature of the whole ocean between Quebec and England to be 56, it will be about 40 degrees warmer than the temperature of Quebec at that season of the year. Again, by a similar investigation, though I have not the exact data before me, I have no doubt it will be found, that the ocean is at most not more than 10 degrees colder during the summer, between those two places, than the mean temperature of Quebec for that time. Thus, upon the whole, it is manifest that the coast of Europe will be more heated by the air from the ocean during winter than it will be cooled during summer. If we had the exact temperature of the ocean in the north, and also in the south, and the mean depth, it would be easy to calculate, from the principles of hydrostatics, how much lower than a mean height the surface of the water in the north stands from its greater specific gravity than that of the south, and the velocity of the current below, towards the south, and of the current above, towards the north, could easily be deduced. In the mean time, I content myself by indicating the principle, and assigning a few reasons for believing that the depression of the surface of the sea in the frigid zone, below that of the torrid, is not less than $27\frac{1}{2}$ feet. The mean temperature of the ocean, within the arctic circle, cannot be far from 32°, for it never rises much above it, and cannot fall much below it, without freezing; for the temperature of the freezing point is stated in the books at 29, though Capt. Parry found it as low as 25, at great depths, on the west side of Greenland, when the temperature of the surface was 32.* At the tropic of Cancer it is about 75°, that is, 43° warmer than the former.

Now water at 32° is about $\frac{1}{22}$ or $\frac{1}{23}$ denser than water at the boiling point 212°: wherefore if the contraction was equable, all the way down from the boiling point to the freezing point, the density of arctic water would be about $\frac{1}{92}$ greater than tropical water. But be-

* In the same latitudes, Capt. Scoresby found on the east side of Greenland, the temperature of the sea gradually increase at great depths, that of the surface being 32. If it should be discovered that the outlet to Baffin's bay is not so deep as Capt. Parry's observation extended, it will afford a satisfactory explanation of the low temperatures of the water at great depths in Baffin's bay. For as it is known that sea water does not follow the law of fresh water, which begins to expand when cooled below 40, but goes on contracting by cold, even down to 18 Fah., provided it does not congeal till it arrives at that temperature, which it will not do if it is kept perfectly still. Now the water, as it cools and condenses in the winter, sinks and carries its temperature with it, and as by hypothesis, the outlet to the bay is too shallow to allow it, by hydrostatic pressure, to flow towards the equator, it lies still at the bottom, and like the lake of Geneva, and some of the lakes of Scotland, whose waters at the bottom are about 41 or 42, it retains this temperature throughout the year. Quere— Does not Capt. Parry's observations prove, that the temperature of the freezing point of sea water is lowered by pressure?

cause the contraction is less at low temperatures than at high, let it be only one-third this quantity, that is $\frac{1}{276}$, then will the polar sea stand below the level of the equatorial $\frac{1}{276}$ of the whole depth.

If now we suppose, as Dr. Young has demonstrated from the velocity of the tidal wave, that the mean depth of the sea is 15840 feet, or three miles, we shall have the difference between the polar and equatorial level of the ocean, in case of equilibrium, 57 feet. But as a current above to the north, and one below to the south, must take place, the difference of level will be only half this quantity, or $27\frac{1}{2}$ feet, as stated above.

It may be objected to this theory, that no such superficial current, with the exception of the Gulf Stream, from the south to the north, is known; on the contrary, it is known that large masses of ice are found in latitudes far south of the arctic circle, which had floated south on the surface of the sea; that it is reasonable to suppose that the surface of the sea at the equator should stand constantly lower than that of polar seas, on account of the superior evaporation there, which is about six feet a year more in the former than in the latter climate, and that the current is actually known to be from the Hebrides to Spain. I grant the correctness of all these facts, and it may be added, that the immense quantity of ice and snow which is melted in the polar regions, during the summer, and which runs down into the ocean, must raise it a little above its mean level, and, as is proved by fact, actually invert the course of the current, in the eastern part of the Atlantic.

Notwithstanding all this, we have no reason to believe there is as much water flowing south on the eastern side of the Atlantic, as there is north on the western side at the surface; and besides all the latter facts which tend to diminish the superficial current to the north, operate to increase the current below towards the south.

Thus have I shown clearly, from theory, that the mean temperature of the Atlantic, in high latitudes, must be greater than that of the land on the same latitudes; consequently, the country to the leeward must have its mean annual temperature increased.

I come now to discuss the subject of rain, the most important of all meteoric phenomena, but one which has never yet been satisfactorily explained. Before I bring forward my own theory, I will observe that the only theory which has ever been advanced, possessing any plausibility, is that of Dr. Hutton.

The Doctor had observed that it frequently rained after he observed two currents of air moving for some time in different directions; and he deserves great credit for anticipating a fact which has since been amply demonstrated by experiment, that if two masses of air, of different temperatures, saturated with moisture, were mingled together, the united mass, with its common temperature, could not contain all the moisture which they contained before the union in the form of vapour, and of course there would be a precipitation. Hence the Doctor inferred, that it was only necessary for large masses of air, containing as much aqueous vapour, or nearly as much, as they could hold, to be mingled together, and rain would be the conse-

quence. This mingling he supposed actually took place when a current above and a current below blew for some time in different directions. Such was the plausibility of this theory that as soon as it was announced it was universally received by philosophers, and after the assumption of the mingling of airs of different temperatures producing deposition was demonstrated, the hypothesis was deemed to rest on the solid basis of fact. I admired the theory for its beauty, and never doubted for a moment the justness of it, until I discovered that the dew point frequently falls just before a rain.

This phenomenon was so contrary to my anticipations, that it could not fail to arrest my attention. If the air was simply mingled together between the two currents, blowing in different directions, I could see no reason for the great and rapid diminution of vapour in the regions below the clouds; for I have known the dew point to fall fourteen degrees, in the space of an hour, just before the rain commenced; though, as I afterwards ascertained, it was raining very hard during this very hour, within a few miles; and at another time it fell 20 degrees in 24 hours, before it began to rain, and when it began to rain it was about 30 degrees below the temperature of the air. By submitting these facts to a careful examination, I was enabled to form a true theory of rain, which I will communicate in a few words, after I shall have submitted Dr. Hutton's to a critical investigation. If any one will consider carefully, he may perceive that two currents of air may move in opposite directions, one above from the north, and one below from the south, for many hours and even days, without interfering much with each other's motion, or mingling together in any great degree. For the very central stratum of air between them will be stationary, and that on each side contiguous to this thin motionless stratum will move very slowly, and that a little further removed from the centre will move a little faster, until at the distance of a few yards, one hundred at most, the currents will move unimpeded and unmingled. I think any one who considers this case carefully and impartially, will grant that a stratum of 100 yards in thickness, is as much as could ever be mingled by different currents, moving even in opposite directions for many days. If this should be granted it will be manifest, that under the most favourable circumstances, when the currents of air mingled together were nearly saturated previous to their union—only a very thin cloud could be formed, which sinking down into the air below would be immediately dissolved if the temperature of this air should be at all above the dew point, which is always the case. But lest the position taken above should not be granted me, and some should think that a much larger quantity of air is mingled by different currents, let us put an extreme case, and suppose 1000 feet thick between the two currents, mingled together. Let us suppose also, what will certainly be allowed to be an extreme case, that these two currents differ in temperature 20 degrees, the temperature of the lower one being sixty, and the temperature of the upper one forty. Let us calculate, on known principles, how much water would be precipitated if both these currents had been saturated, previous to

mixture. By examining the table at the end of this article, it will be seen that a cubic inch of air whose dew point is sixty, contains .00338832 grains of water, and a cubic inch whose dew point is fifty, contains .00246714 grains; wherefore a cubic inch. whose temperature was reduced from 60 to 50 will precipitate the difference between these two quantities; that is, .00092118 grains, and the 500 feet in height will precipitate for every square inch of horizontal surface 6000 times .00092118, or 5.52708 grains. Moreover, a cubic inch of air of which the dew point is forty, contains .00178229 grains of water, and this subtracted from the quantity contained in a cubic inch whose dew point is fifty, as shown above, leaves .00068485 grains, which is the quantity that will be taken up for every square inch of horizontal surface and inch of perpendicular height of the 500 feet, whose temperature is elevated from 40° to 50°, giving a total of 4.10910 grains. Subtract this from 5.52708, the quantity precipitated from the 500 feet whose temperature was depressed, and there will remain 1.41798 grains, for the whole quantity of rain per square inch produced by this mixture of 1000 feet perpendicular height of air; not quite a grain and one-half on a square inch of surface: and even this small quantity would be diminished by a principle not taken into the account in the above calculation, namely, if two equal masses of air saturated with vapour of different temperatures be mingled together, the temperature of the mixture will be above the mean, for the vapour which is precipitated will raise the temperature by the evolution of latent caloric. Now as the lower portion of the atmosphere is never saturated with vapour, excepting when there is a fog, this minute portion of rain, as formed above, would not fall many feet in the air below, until the whole of it would be turned to vapour again, and none of it would reach the earth. Thus have I shown, by calculation from established principles, that rain could not be produced by the mixing of even much larger portions of atmospheric air, than are likely to be mixed by currents moving in different directions, even when these currents are saturated, a circumstance which seldom, or perhaps never, takes place in nature.

Another theory of less celebrity has been advanced by Mr. Morin. According to this author, rain can only be produced by compression of the air into a smaller space, as where it is forced against the sides of mountains by winds: or by refrigeration, caused by radiation from the cloud itself. Now most unfortunately for the first part of this theory—even if we grant that air is condensed by winds against the sides of mountains—experiment proves that the increase of heat by condensing air always *increases* its power of containing vapour. And as to the second part of the theory—refrigeration by radiation from the cloud itself—it is defective in not accounting for the formation of the cloud. And even after a cloud is formed it is not at all likely that radiation from it is more rapid than from the surface of the earth in a clear night. Now we know from the phenomenon of dew that this radiation is too slow to account for the rapid formation of rain, as it occurs in nature.

It remains now to show the true cause of rain.

It is caused by the rush of the vapour itself, from the warm cur-

rent of air where it is denser and more tense, into the cold current of air, where it is immediately condensed into water.

The proof of this depends upon two facts. First, the great discovery of Dalton, that vapour forms an atmosphere of its own, the particles of which press only on each other; and consequently the superior strata of vapour are not buoyed up by the atmospheric air, but are supported entirely by the elasticity of the vapour below; and secondly, the actual depression of the dew point sometimes just before a rain.

What resistance air makes to vapour passing through it, or what is the greatest velocity, with which vapour can pass through a given mass of air, with a given tension, I have not been able to determine; but that it does pass with considerable velocity, the falling of the dew point 14° in one hour, affords abundant proof. Now this rush of vapour, into the cold current of air, answers the purpose of mingling the two currents together, in producing a common temperature; for the vapour in condensing into water in the cold current, gives out its latent heat, and when it falls down into the warmer current below, it cools it both by its own temperature being lower, and by evaporating again, provided the current below is not saturated; and this process goes on, raining above, and evaporating below; the point of deposition ascending, and the point of evaporation descending, until finally the rain reaches the earth, just as the stratum below is cooled down very near the dew point. And this is what takes place in every rain which is caused by a cold current above, and a warm current below, moving in different directions. Lest I might be misunderstood, by a cold current above, I mean one colder than that which is due to the elevation, that is, more than one degree colder for every hundred yards of elevation. If a rain should occur from the warm current being above, and the greater density of vapour in it, then the dew point will rise before the rain —the vapour below being rendered more dense by the pressure of the superior quantity of vapour above.

But there is another way by which rain is produced, and that is by the gradual increase of vapour in the atmosphere, until it rises into a temperature too low to correspond with its density; for the elasticity of vapour being much greater than that of air, its density does not decrease in ascending as fast as the temperature; which has been fully illustrated by Mr. Daniell. Rain is produced by this cause, generally, in those parts of the torrid zone where it rains every afternoon. The vapour goes on increasing both in quantity and elasticity from heat, till the hottest part of the day, soon after which, the upper part of the vaporic atmosphere begins to condense into water, by being thrust up by its own elasticity, into a region of cold, below its dew point; and as the air below is almost saturated, the drops of rain coming down into it, colder than the vapour there, condense a portion of this vapour, and thus increase in size until they descend into air, whose dew point is four or five degrees below the temperature of the air, which is generally the case near the surface of the earth. The rains near the equator, where there can hardly be cold

currents of air above, I think must all be caused in this way; but in our climate, we may expect to see rains often produced by cold currents of air overlapping warm ones—and such rains may always be predicted by the falling of the dew point. Every rain which occurred last April, was preceded by a fall of the dew point, from 6 to 24 hours before the commencement of the rain. During May, June and July, the rains have been of the equatorial character; the dew point has generally risen gradually to about seventy-two or three—that is within about two or three degrees of the mean temperature of the day, soon after which it commenced raining—sometimes with a slight fall of the dew point just before the rain—and only once with a sudden rise of three degrees, just before the rain commenced.

One phenomenon worth mentioning is, that on the 23d of June, I observed the clouds moving in different directions, the cirrus or upper clouds were coming from the south-west and the lower from the north. I have observed the upper clouds ever since that period (two days excepted, in which there were none,) constantly coming from that direction or from the west or some point between these extremes, and it is now the third of August. During this time the wind below has blown from every point of the compass. On the second of August, the lower clouds moved rapidly all day from the south, and the upper very slowly from the west, in the night there was some rain, and the next morning the lower clouds were moving rapidly from the north-west by north, and the upper clouds were moving from the south-west. Both these changes indicated to me that a great rain had taken place to the north. For when a large portion of vapour is condensed into rain, the diminution of volume which takes place can more easily be supplied by the subsidence of the air over the cloud, than it can by the air from the sides, which meets with much resistance from the obstacles on the surface of the earth. Therefore, the column of air immediately over the cloud will sink whilst it is raining, and the air at the surface of the atmosphere will run towards the cloud in all directions to restore equilibrium. Nor will it stop exactly at the moment when equilibrium is restored; it will accumulate where it was depressed before—the barometer will rise, and the air near the surface of the earth will be pressed outwards in all directions, from the region where it rained, and it will carry with it a great depression of the dew point—and some depression also of the temperature of the air. All these occurrences have taken place, and I anticipate, with great certainty, the report of a great rain on the night of the second of August, having occurred some place to the north of Philadelphia. I never yet have failed in predicting in what quarter the rain took place, when the phenomena were so marked as they have been in the present case. What I have said of the air being cooler, which blows from the rain, is not to be understood as recognising the principle, asserted by some writers, that it is colder because it comes from the upper regions of the air—*that*, I consider, I have demonstrated to be incorrect—it is colder because the rain descending from a great height

cools the stratum of air under the cloud, and this is chiefly the air that diffuses itself laterally. Indeed, as was shown before, the air in the cloud itself during the condensation of the vapour into drops of rain, is made warmer by the evolution of the latent caloric of the vapour, and this is one reason, perhaps the only one, that a pound of air (I do not say a gallon,) contains more caloric in the upper regions, than a pound below. If I have not been successful in convincing gentlemen who have embraced the opposite doctrine, I will ask them to explain why, on their principles, the air ceases to blow downwards immediately after it ceases to rain? If the whole column of air is colder and denser in consequence of having descended, than the air surrounding it, which has not descended, it should continue to blow downwards for ever, on the principle of greater specific gravity; for the air would manifestly flow in above, to preserve the level at the surface of the atmosphere.

I do not purpose to enter upon the subject of the trade winds at present; but I may simply observe that if I have been successful in showing that any theory, to account for the semi-diurnal fluctuations of the barometer, which assumes for its basis an alternate increase and diminution of gravitating matter over the barometer, is utterly without foundation, Professor Mitchell will discover that it contains also a refutation of his doctrine of vortexes. Besides if I understand the Professor's reasoning, and also his statement that the air at the surface of the atmosphere in the torrid zone runs eastwardly from noon and not westwardly, it will follow, that the barometer will stand higher some time after noon—than some time before it—which is not the fact.

The able reviewer (Professor Renwick, I believe,) of Mr. Daniell, Am. Quarterly Review, for March 1828, will discover also that he was too hasty in admitting, that as soon as the sun heats the air hotter than that in surrounding parts, the barometer falls, and the air begins to move in all directions towards the heated part, when in fact the first effect of heating air is the very reverse of this, both as to the barometer and the motion of the air; for the barometer will rise, and the motion of the air will be in all directions from the centre of greatest heat; and before the current can begin to move the other way, the air must have had time to run off above, so that the mass of gravitating matter may be diminished over the heated part. This latter effect however will not have time to take place, if the point of greatest heat moves with a velocity of a thousand miles an hour; for then, as was shown above, the air will not have time to spread itself over surrounding regions. Professor Olmsted of Yale College, who has written on the causes of hail, will also perceive how easy it is to account for this meteor by admitting the fact that dense vapour in one stratum of air may permeate another stratum where it is less dense, and very cold, with great rapidity—which, independent of theory, is rendered very probable by my observations on the dew point. The French also may learn to lay aside their paragreles; for unless they can prevent cold strata of air from overlapping warm ones, or prevent the vapour from shooting up into these

cold strata by its own elasticity, they will never be able to prevent hail.

As to the settling of moisture on a tumbler of cold well water, being a sign of rain, which is believed in many other places besides New Haven--there have been but seven days in the months of June and July, in which this would not have been given to any one who "seeketh after a sign," for the dew point was above fifty-five, the common temperature of well water, on every other day.

Notwithstanding the fallacy of the New Haven sign, it is to observations on the rise and fall of the dew point that we must look for means to predict the weather, and if this *point* is faithfully attended to, the result will be *success*.

The following table is extracted from the Edinburgh Encyclopedia—article Hygrometer, and is referred to in the preceding essay.

Temperature.	Weight, in grains, of the water in a cubic inch of vapour at the corresponding temperatures, Fah.	Temperature.	Weight, in grains, of the water in a cubic inch of vapour at the corresponding temperatures, Fah.	Temperature.	Weight, in grains, of the water in a cubic inch of vapour at the corresponding temperatures, Fah.
10	.00064161	34	.00146102	58	.00318197
11	.00066451	35	.00151051	59	.00328366
12	.00068825	36	.00156156	60	.00338832
13	.00071280	37	.00161424	61	.00349599
14	.00073810	38	.00166852	62	.00360679
15	.00076429	39	.00172454	63	.00372089
16	.00079136	40	.00178229	64	.00383826
17	.00081931	41	.00184189	65	.00395897
18	.00084819	42	.00190325	66	.00408317
19	.00087801	43	.00196651	67	.00421091
20	.00090882	44	.00203178	68	.00434230
21	.00094051	45	.00209899	69	.00447745
22	.00097337	46	.00216827	70	.00461639
23	.00100732	47	.00223878	71	.00475930
24	.00104235	48	.00231326	72	.00490628
25	.00107851	49	.00238903	73	.00505729
26	.00111588	50	.00246714	74	.00521259
27	.00115446	51	.00254757	75	.00537226
28	.00119420	52	.00263044	76	.00553634
29	.00123522	53	.00271574	77	.00570487
30	.00127758	54	.00280358	78	.00587810
31	.00132134	55	.00289415	79	.00605617
32	.00136636	56	.00298729	80	.00623919
33	.00141303	57	.00308325		

Description of Lieut. Cook's method of converting a Boat used for ordinary purposes into a Life Boat, at pleasure. Communicated by the inventor.

Notwithstanding that many plans for life boats for ships have been offered to the notice of the public, and that some have been partially introduced into the royal navy, to the best of the inventor's knowledge, there is not, at the present moment, a boat adopted by any service, whether British or foreign, naval or mercantile, calculated to despatch in a gale of wind, either to board a vessel at sea, to pick up a man who may have fallen overboard, or to send through a heavy surf to the shore, however great may be the case of emergency, although thousands of men have perished in such attempts!

To carry a life boat, in addition to the usual complement of boats, is out of the question; want of room alone is a sufficient objection. To take one, instead of another used for ordinary purposes, but which is not equally convenient and serviceable for common use, would also be objected to; while those plans which purposed to convert common boats into life boats, by moveable air tight cases, have been altogether thrown aside as cumbersome, and liable to the further objection of becoming waterlogged by the first sea that broke into them. It is then in the hope of having completely steered clear of the imperfections, which the opinion of nautical men attached to former ingenious contrivances, that the inventor respectfully offers to the notice of the maritime world at large, a very simple, cheap, and expeditious mode of converting *any* boat used for ordinary purposes, into a life boat, at pleasure, which cannot sink, nor become waterlogged, and into which, when a sea breaks, it will run out of itself, without exertion on the part of the crew. The invention is not one of problematical kind. It has been tried, officially tried, and most highly approved of, by an experienced and impartial officer, in a heavy surf on Deal beach, than which, a better place could not have been selected by the Hon. Navy Board. It was tried in the presence of officers of almost every rank in the navy, and in the presence of the first boatmen in the world, for whose use it is that Captain Pigot has recommended one to be kept on board the Gull-stream light. The Deal men declared it to be their conviction, that had they had a boat on this principle, 18 feet long, to have carried off in one of their large boats, to a vessel which was wrecked some time ago on the Goodwin Sands, the crew might have been saved; whereas, although eleven of the large boats succeeded in getting off, and actually anchored to windward of, and very near the wreck, it was only to have the melancholy and heart rending spectacle of beholding the crew drop from the rigging one after another into the sea; for owing to the broken water they dared not make any further effort to approach the perishing crew.

The invention consists principally in its having a neat shelf-piece of wood round the inside, level with the thwarts, about 5 inches wide by $1\frac{1}{2}$ inch thick, containing a groove 2 inches wide, by half an inch

deep, in the middle of which are metal pins or bolts, 18 inches apart, fitted with screws and finger nuts at their upper ends. By these, light metal battens, (fluted underneath, and of the dimensions of the groove,) are firmly secured down on the edge of the canvass deck, when spread, as will be hereafter explained. On a level with the shelf-piece, four or more small brass circular screw scupper plates, 3 inches in diameter, and of the thickness of the plank, are neatly let into the sides of the boat, so as to be perfectly water tight. Two others, rather larger in diameter, are fitted through the stern. These are the only material alterations, and so far from their having an unsightly appearance they are really ornamental.

The above description will serve to show how very little in appearance this boat differs from those now used for ordinary purposes; while in five minutes it can be converted into a life boat, simply by spreading over the canvass deck, which is intended to keep the water from getting below the thwarts when a sea breaks into the boat, and which, in doubtful weather, or on detached service, may be kept in a cloak bag under the fore sheets. The water which does not run over the gunwale, escapes through the scupper holes. The edge of the canvass is bound all round with thin leather. In the binding eyelet holes are worked, 18 inches apart, to correspond with the position of the pins or bolts in the groove, over which they are hooked previously to placing on the battens, which, when screwed down into the groove, effectually prevent the water from passing the edge of the deck.

Each rower has a bag sufficiently large to contain his legs, his feet being placed on the stretcher: opposite to him is a spare bag, which, until wanted, may be turned inside out, and rolled up. There are also spare bags in the stern sheets. In very large boats, such as launchers, an aperture in the deck might be provided, properly secured, of sufficient dimensions to admit the body of a man, so that in a gale of wind, on detached service, a part of the crew—the canvass not being air-tight—might rest under cover: or in fine weather, in tropical climates, while thus employed, the whole of the boat might be covered over, excepting the stern sheets, to protect the men from the rays of the sun by day, and from the dews by night.

Lest the boat should leak, or in the event of any water oozing through the canvass, a hand pump is provided to keep her free: provision is likewise made for stepping the masts when required.

The fenders, made of cork shavings, and in a canvass tube the whole length of the boat, are in their construction, as well as in their mode of application, extremely simple, and were greatly approved of at Deal, not only on account of the security they afford to the boat in going alongside a wreck, but on account of the additional stability they give; and on account of their capability to support the crew, should a hole by any accident be knocked through the bottom of the boat.

An iron keel is also provided, so fitted outside, that in the event of an emergency, such as knocking a hole through the bottom of the boat, it can be instantaneously detatched by pulling a trigger; other

modes, however, of ballasting the boat, may be preferred by the different commanders of ships. The inventor names this for the information of such as may feel desirous of having it.

Explanation of the other inventions adverted to in Capt. Pigot's Report.

TACKLE FALL BLOCK.

Fig. 1.

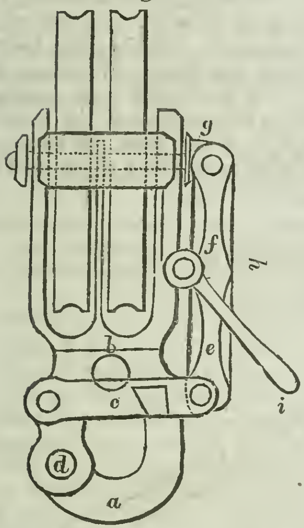


Fig. 1, is a view of the "tackle fall block," the object of which is to enable the crew to disengage the boat from the stern, or from both head and stern tackle falls in an instant, with such precision and certainty, as to remove the greatest part of the danger, connected with despatching a boat in a hurry, or in bad weather. *a* is the hook, the end of which rests firmly on the frame of the block *b; c* is the fork which keeps the hook from turning round at the joint *d; e, f,* are two legs, the former joined to the fork *c,* the latter to the pin of the block *g,* and are united together by a rule joint at *h.* While in their present straight position, they keep the fork, *c,* from liberating the hook *a;* but on the handle, *i,* being pulled, the legs *e, f,* form an angle like the dotted lines in fig. 4, when the fork releases the end of the hook, which instantaneously disengages the boat.

SHEET LIBERATOR.

Fig 2

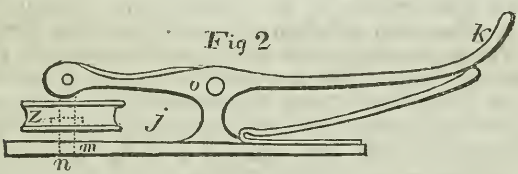
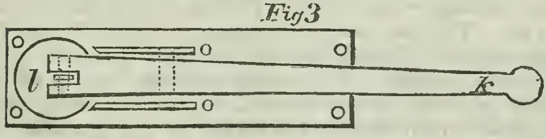


Fig 3



Figs. 2 and 3 are different views of the "sheet liberator." This simple apparatus effectually removes the necessity of employing men to stand by the sheets, when under a press of sail in boats in squally weather, and when their services may be much needed at the oars. It is no uncommon thing to hear of boats being found upset, with their sheets belayed. The inventor belonged to a frigate whose cutter was discovered in this situation; not one of the crew, consisting of an officer and thirteen men, escaped! all met with a watery grave. The liberator is fixed to the inside of the boat nearly in the position of fig. 3. The single part of the sheet is rove through the aperture *j*, and belayed forward. Should a sudden gust of wind take the sail, touch the lever *k*, and the shieve *l* turns round, relieving the boat, by releasing the bight of the sheet, without the danger of letting it fly. Although the shieve turns freely, it is prevented from coming off the spindle by a small nut. While in the position of fig. 2, the end of the spindle, *m*, rests in the socket, *n*, of the plate, the ears, *o*, of which, prevent the short end of the lever from being lifted up by the flapping of the sail.

BOAT'S GRIPES LIBERATOR.

Fig. 4.

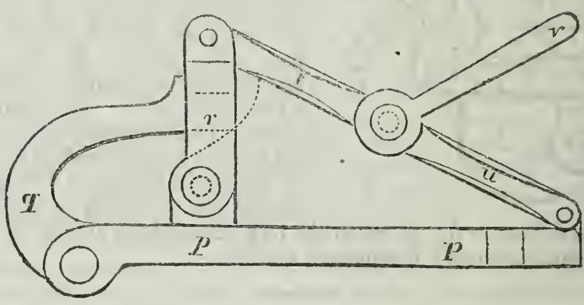


Fig. 4, is a representation of the "boat's gripes liberator." The plate *p*, is to be screwed or bolted to, and by, the edge of the mizen channels. The gripes being all of one piece, a thimble is to be seized into the middle or bight: this thimble is to be placed over the hook *q*, the end of which rests firmly on a stud cast in the plate *p*, to which the fork *r*, is bolted at *s*. The fork being kept in its perpendicular position by the two legs, *t* and *u*, as in fig. 1, it prevents the hook from turning round, until by pulling the handle *v*, it is permitted so to do. The two ends of the gripes are passed from the channels under the boat, brought up over the outer gunwale, and are set up by laniards as usual. It is evident that by casting off the bight or standing part, the boat is lowered down from under the gripes, and will clear herself should they be foul of the gunwale; whereas, by casting off the laniards, she is lowered down upon the gripes, and

is sure of being turned bottom upwards, should their being entangled pass unobserved.

To prevent corrosion no iron is used.

[*Rep. Pat. Inv.*

Remarks on the Novelty and Utility required in an Invention, to be the Subject of a Patent, in England.—To the Editor of the London Journal of Arts.

Sir,—It is a generally received doctrine that an invention, to be the subject of a Patent, must be new and useful, but it is not so well understood what constitutes novelty and utility, and how far either or both must exist.

Mr. Holroyd, in his law of Patents, p. 19, says, "whether an invention be new and useful is a question of fact proper for a jury."

"But it may be safely laid down that whatever be the nature of an invention, whether the merit of it rests on discovery, or on improvement, novelty and utility must exist in a material degree."

Now inventions do not always contain novelty and utility in equal portions; but in some, novelty is predominant, in others, utility; in some the novelty is very great, the utility trifling, in others the novelty is just discernible, and the useful effect very great. And though it is very certain that the sum of the two must be considerable, yet it is not easy to say where the sufficiency of each begins. That can only be ascertained by examination of the case upon record, where the sufficiency of novelty and utility of invention, has been brought into question.

In some cases where Patents have been supported, the novelty of the inventions has been trifling, and the merit of the Patents, on the strength of which they were supported, was their great utility. For instance, in Huddart's Patent for rope machinery, the novelty *per se* was only trifling, (see Davis's Patent cases, p. 265.)

But however trifling it might be, it had a very important effect, for by virtue of it, Captain Huddart made better cables and cordage, than had been made before, and the Patent was supported.

Again, in Daniell's Patent of 1824, the invention was plunging cloth, made in the common way, into hot water, after it had been dressed; this would seem a very small amount of novelty, or invention, but its effect was to produce a great improvement in the cloth; and assuming it not to have been practised before, the Patent was held good, and J. Fussell who used steam instead of hot water, for the same purpose, was held an infringer, and his Patent repealed. (See Appendix to the Report of the Committee of Patents, p. 211, the King against Fussell.)

Again, in Brunton's Patent, for improvements in ships' anchors and windlasses, and chain cables or moorings. The difference between Brunton's chain cables and Captain Brown's (who had preceded him) was a trifle. Captain Brown made his cables with twisted links, a wrought iron stay being fixed across the middle of the

opening of each link to keep them from collapsing. The links of Brunton's chain cables were not twisted, but made in the strongest form, and the stays across the links were made of cast iron, with broad ends adapted to the sides of the links, and embracing them. Brunton's links had come into general use for chain cables in place of Brown's, who himself had also adopted Brunton's links. The jury considered Brunton's chain cable new and useful; and afterwards on a motion for a new trial, the Lord Chief Justice, Abbot, confirmed their opinion as to the *sufficient novelty* of the chain cable, although he held the Patent bad on other grounds.—(See Appendix to Report of Patent Committee, p. 206.)

In all these cases the novelty was *per se* inconsiderable; but such as it was, by being combined skilfully with mechanism or processes known before, it went to produce important results in the shape of better cordage, chain cables, and cloth, than had been produced before; so that the public got really better things than they had had before the inventions: therefore, the inventions were held sufficiently new to comply with the law.

Absolute want of utility, or total failure in operation, of course avoids a Patent; as, however, such abortive inventions are rarely brought into court, there can be but few cases on record of decisions against them. But Patents have frequently been brought forward in court, grounded on inventions, in which the novelty has been more prominent than the utility, and in which the latter if not absolutely disproved, has failed to be established. Such patents have been generally brought forward merely as weapons of offence, to demolish other later patents for inventions founded on a similar principle, but differing somewhat in their practical combination and organization. As for instance, Balfour's Patent cited against Huddart's, in *Huddart* against *Grimshaw*.—(See Davies, p. 265, and Kirke and White's patent cited against Kneller's in *Hallett* against *Hague.*)

In most of these cases, the patents, which have taken a stand on their utility, have been maintained in spite of the preceding ones, which could not show utility; that is, the difference between the inventions, has generally been held sufficient to support the later patent.

It appears, therefore, from examination of the most important case, that utility is the quality most rigorously exacted by the law. For, first, an invention, however novel, which has not succeeded in practice, and has consequently been useless to the public, is not suffered to clog the operation of a subsequent invention which does succeed, and which though it may differ little from the first in appearance, differs from it in reality in something, by virtue of which it produces a better result, as in Huddart's case before cited, and in the late case of Hallett against Hague, tried in the Court of King's Bench, 26th of February, 1831.*

* In Hallett against Hague for an infringement of Kneller's patent,—Kirke and White had a patent, in 1822, " for a process for more rapid crystallization,

And, secondly, an invention which is held sufficiently new, and is also successful in practice, is supported against infringement by colourable evasions, as in the trials of Watt's patent; Clegg's patent for a gassmeter in Crossley against Beverley; and Daniell's patent in the King against Fussell.

Hence we may conclude, that when commanding utility is proved, a moderate share of novelty is sufficient to satisfy the law, because the utility is held *per se* novelty. For if an invention produces that which the public had not before, and which they prize highly, the *result* is the novelty, and it matters little in fact or in law, whether the means by which that valuable and new result is obtained, be trifling or not. It is not meant to be asserted, that a good machine or process possessing no novelty whatever, is merely on account of its goodness a subject for a patent; but it is barely possible, that a new effect, a result much better than previous results, can be obtained by virtue of no change whatever in the means; and if there is a change, although it be small, yet if its effects are great, and if it produces a beneficial result for the public, by giving them something real and useful, which they had not before, it may be expected, that a patent, grounded upon such change in the means, will stand firm as to novelty.

The truth is, that great novelty is becoming daily a more rare and difficult thing to attain;* and by reason of the minute subdivision that characterizes the present state of the useful arts, and the great extension of production in every branch of them, minute differences in the means employed, cause great difference in the results to the public. Hence there is value and merit in those minute differences; and it being daily more and more difficult to distinguish between them, we consider the results instead of the means, because

and for the evaporation of fluids at a comparatively low temperature." And Kneller took afterwards a patent for "certain improvements in evaporating sugar," &c.

It was contended by the defendants, who had the right of using Kirke and White's invention, that Kneller's specification described an invention essentially the same as Kirke and White's, although the construction of the one apparatus was somewhat different from that of the other: that hence, Kneller's apparatus came under Kirke and White's patent, and therefore, that they had a right to use Kneller's apparatus as a mere modification of their own.

It was proved that Kirke and White's invention had not come into use, and the defendants could not prove that it would answer the purpose, or was so effective as known methods of producing evaporation.

On the opposite side it was shown, that the difference between Kneller's invention and Kirke and White's, whether trifling or not, sufficed to make Kneller's apparatus answer the purpose; of which the proof was, that competent witnesses had tried it, and found it succeed upon experiment; and further, that it was in actual practice for trade at the plaintiff's sugar-house. Kneller's patent was supported against the infringement, and afterwards on a motion for a new trial, the verdict was confirmed by the court.

* This is not wonderful, considering that since the year 1675, 5539 patents have been granted (to say nothing of the inventions for which patents are not taken,) and considering further that hardly a month passes without two or three inventions on the same subject.

in the former, the good and the evil are magnified, so as to exhibit differences that the judgment can seize, as a microscope will make visible differences between things, that, to the naked eye, appear similar. [*London Jour. Arts.*

Cement from Iron Filings.

M. Mailtre having reflected upon the action of vinegar in the preparation of the cement known as *mastic le limaille*, which is made of iron filings, garlic, and vinegar, so proportioned as to form a mass of moderate consistency, proposed to substitute for the vinegar sulphuric acid, diluted with water, in the proportion of one ounce to a little more than two pints of water, and to reject the garlic as useless. This alteration was soon adopted by all to whom he communicated it in Paris, and will save, in Paris alone, more than ten thousand francs annually. This cement is there employed to close the seams of stones with which terraces are covered. The iron filings becoming oxidized, occupy a larger space—their oxidation being facilitated by the action of the acid, and the joints become exactly closed.

[*Mechanics' Magazine.*

Mr. Collinge's Spherical Hinge.

Sir,—As it may not be generally known, that Mr. Collinge's spherical hinge is constructed upon the purest anatomical principles; and, as I am in the habit of illustrating my remarks upon the "mechanical structure of the human skeleton, compared with those of animals," in my popular lectures on that subject, by an exhibition of this invention, I deem it right to trouble you with a few observations on the structure of the hinge, and the joint it imitates. In doing so, I have no other object in view than to make more generally known the great ingenuity of the inventor; and to observe that this constitutes an illustration of the beneficial consequences that may result from the diffusion of that knowledge which teaches the component parts of animal bodies, which are well known to be constructed upon the truest mechanical principles.

The hip joint forms that species of articulation denominated, by anatomists, *enarthrosis*, or the ball and socket joint, by means of which the inferior extremity can be moved, in a circular direction, every way: the head of the thigh bone forming a large ball, which is received into a corresponding cup or cavity formed for its reception in the hip bone. Now this is exactly the mode of construction followed by Mr. Collinge, in his patent hinge. The resemblance is carried even farther. In the living joint a small quantity of synovia is secreted, by a series of diminutive glands, for the purpose of lubricating the surfaces in contact, and preventing the effects of friction. This is popularly, and not inaptly, called *joint oil;* though, in point of fact, it is not an animal oil, but resembles albumen, or white of egg. In Mr. Collinge's hinge there is, in the same way, an aper-

ture to admit a small portion of oil at the top, with another at the bottom, for its escape, when a new supply is required; and, to complete the imitation of nature, the whole is constructed perfectly air-tight.

I understand this species of hinge is now extensively used for gates, rudders, &c. for which purpose I should conceive it to be excellently adapted.

Yours, &c.
W. H. Dewhurst, *Surgeon.*
Professor of Human and Comparative Anatomy.

Fig. 1.

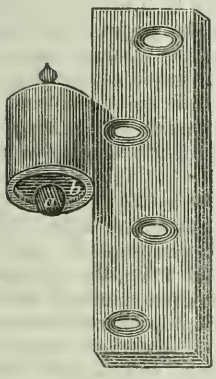


Fig. 2.

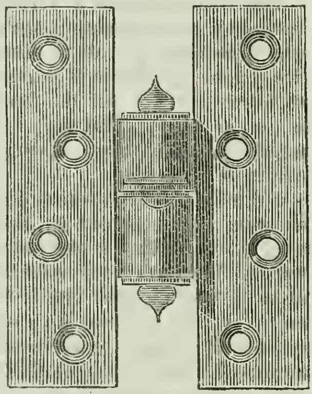


Fig. 3.

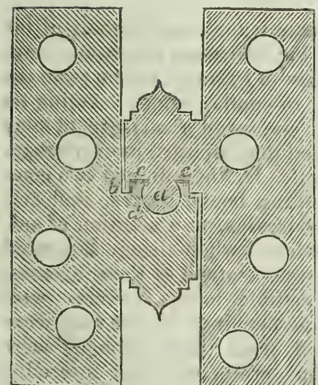
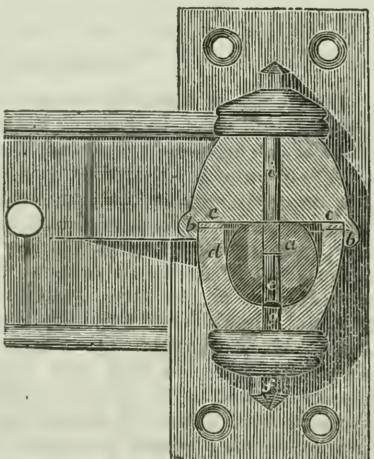


Fig. 4.



Description.

Fig. 1, is a perspective view of the upper half of a patent improved butt hinge; *a* shows the spherical bearing, which moves in a hemispherical cavity, made in the lower half of the hinge; *b* shows the recess, in which is placed a leather collar, to exclude air and dust.

Fig. 2, is an elevation of the same hinge, when the upper and lower halves are united.

Fig. 3, is a vertical section of Fig. 2; *a* the spherical bearing; *b*, *b*, the recess which contains the leather collar *c*, *c*; *d* the hemispherical cavity which contains the spherical bearing *a*, and also the oil necessary to lubricate the surfaces, and thereby prevent friction.

Fig. 4, represents a vertical section of parts of a hinge, suitable for heavy gates; *e* shows the groove formed in the spherical bearing, which permits the oil to flow up and lubricate the bearing surfaces every time the hinge is moved; *f* the head of a screw which may be withdrawn to let out the foul oil through the hole *g*; *h*, the head of a similar screw, that may be taken out when fresh oil is applied, which will run down through the hole *i*, and fill the hemispherical cavity *d*.

[We give above a more particular description of the invention so obligingly pointed out by Mr. Dewhurst, to the attention of our readers; it is, indeed, a most ingenious and very philosophical contrivance. We have been informed that, in the year 1798, the principle of this invention was applied to support an immense windmill shaft, on Sir Bethel Codrington's sugar estate in Antigua, where it remained, without inspection, nineteen years and a half; and that, when examined, it was apparent that the spherical pivot, and receiver, had never been in contact, the oil having kept their surfaces in a state of constant separation, and prevented all friction.—Ed. Mec. Mag.]

Protection of Firemen.

On the 4th of April M. Gregori communicated some details of the experiments recently made in Italy by the Marquess Origo, commandant of the firemen at Rome, with a view to guarantee them from the effects of entering houses while a prey to conflagration. Acting on the received opinion that the Romans employed a mixture of clay and vinegar to extinguish flames, he tried that mixture in every manner, but it produced no satisfactory result. He then dipped two complete suits of firemen's dresses, including boots, gloves, and two cowls, made of the same cloth as the dresses, in a solution of sulphate of alumine and sulphate of lime, and when dried, saturated them with soap water. Two firemen were clothed in these dresses, and their faces covered with incombustible masks, covered with cloth saturated with a saline solution; the openings for the eyes were covered with a web of amianthus, and small damp sponges were placed in their mouth and ears. Thus protected, they entered a house, 23 feet long and 3 feet wide, filled with burning wood, which they traversed ten times without the slightest injury. Their clothes

were not damaged, although they had remained fifteen minutes exposed to the action of the flames. The only effect produced on the men was the increase of the pulsation from 70 to 125. These dresses cost but two pounds sterling each; and are, therefore, in that respect more eligible than those composed of amianthus, as recommended by the Chevalier Aldini. M. Origo also extinguished flames of considerable violence by playing on them with the solution of sulphate of alumine and clay, by means of a common engine.—*Royal Academy of Sciences of Paris.*

Bibliographical Notices.

A Treatise on Mechanics, by Captain Henry Kater, Vice President, Royal Society, and Rev. Dionysius Lardner, LL.D. F. R. S. L. & E.

The above named work, which makes the fifth volume of Dr. Lardner's Cabinet Cyclopedia, has been reprinted both in Boston and Philadelphia. In this volume, the general properties of matter are explained in a clear and familiar manner; this, with The Laws of Motion; Gravitation; The Simple Machines, or Mechanic Powers; Wheel Work; The Means of Modifying Motion; Friction, and the Rigidity of Cords; The Strength of Materials; and an Investigation of the Nature and Uses of Balances and Pendulums, constitute the contents of the work. The different parts of the subject are treated without the introduction of mathematical formulæ, and the writers have been eminently successful in stepping down from the eminence on which they stand, to lead others up in the paths of science. The difficulty of doing this has been fully evinced in some of the numbers of the *Library of Useful Knowledge*, and other works intended for popular instruction, which, although they have evinced the learning of their authors, have too frequently been very illy adapted to the end proposed.

In the present work, the illustrations are very happily chosen; the beaten track has been departed from in many instances, so that those who have the popular treatises on mechanics upon their shelves, may still peruse this with real advantage. The chapter on Balances and Pendulums contains more direct and satisfactory information on these subjects than can be any where else found in the same compass.

The Academic Pioneer—conducted by the Editorial Committee of the Western Academic Institute, No. 1, *Vol. I. Cincinnati,* 1831.

We have just received the above pamphlet, and learn from it that the *Academic Institute*, consists of an association of teachers in the city of Cincinnati, formed for promoting the cause of general education. It is proposed by them to publish a monthly journal, at two dollars per annum, to diffuse such information as may be thought

most conducive to the object in view. The number before us is intended to form the first of the series. Its contents are an Address by C. B. M'Kee; The Constitution of the Society; A Discourse on Education, by the Rev. Dr. Bishop, President of Miami University; Address by Mr. Alexander Kinmont; Officers; Prospectus, &c.

Although we do not find in either of the published addresses any thing particularly novel, or striking, and have to regret that in point of composition they are not more creditable to their authors, yet we rejoice to see the teachers of youth uniting together in order to pursue measures calculated to enlarge their own sphere of knowledge, and, of course, to promote the improvement of the pupils committed to their care.

Knowledge for the People, or the Plain Why and Because. By John Timbs, Editor of 'Loconics' Arcana of Science and Arts, &c. No. 1, 18mo. 72 pages, 12½ cts. Lilly & Wart, Boston.

This is a very good title to a very indifferent book. The Whys are in most cases well enough, but the Becauses are, in numerous instances, *non sequcters*, or tend to "darken council with words without knowledge." This "Knowledge for the People" proceeds upon the supposition that the people already know all about the meaning of oxygen, hydrogen, and other chemical agents, as well as many other things, which, if they did know, such a work as the author *intended* to produce, would be of very little value.

The first question is, "*Why are coke and charcoal fires free from smoke?*" and the reply, "Because their moisture has been previously dissipated; this moisture producing the smoke of coal fires." Should some schoolboy ask Mr. Timbs, why it is then that moistened charcoal does not smoke when put upon the fire, he would have to imagine some other Because before he could answer the question. Is it the moisture in pitch, tar, resins and oils, which causes them to smoke when burnt?

The next Because introduces 'gases,' 'active caloric,' 'latent heat,' 'radient heat,' &c. &c. as familiar acquaintances of *the people.* We have a very intelligent community in the United States, but the great body of the operative classes of England must leave ours far in the rear, if they can derive instruction from Becauses thus constructed.

At page 4, we have "Why does sunshine extinguish a fire? Because the rays engage the oxygen which had hitherto supported the fire." We really know not what kind of engagement is here intended; for although the sun is introduced, and actively concerned in the contest, he does not throw any light upon the subject.

At page 5th we learn, that sulphur thrown upon a fire not only decomposes the atmospheric air, but absolutely *annihilates* it.

We might notice similar absurdities, on almost every page, intermixed, it is true, with some good Becauses, borrowed from Arnott, and others, and possibly, in some instances, supplied by the author himself.

Should the parts which are to follow manifest as little tact at explanation, and as much ignorance of the subjects to be explained, we hope that the American publishers will cause them to be expurgated and remodelled, before they are placed in the hands of our 'People.'

Since writing the foregoing we have seen two additional numbers, the 2nd and 3d, of the Plain Why and Because; the second is devoted to Zoology, the third to Origins and Antiquities. In point of general correctness they are to be preferred to the first number, but still we find in them but little to praise, or to approve. The same want of plainness in the Becauses, pervades the whole, and interferes with the utility of the work. The number on origins and antiquities, relates principally to manners and customs in England upon points but little understood, and possessing but little interest, in this country.

Scientific Tracts designed for instruction and entertainment, and adapted to Schools, Lyceums, and Families; conducted by Josiah Holbrook and others. $1 50 per annum for twenty-four numbers in 12mo. 24 pages each, Carter & Hendee, Boston.

We have seen thirteen numbers of this publication, and although upon the whole we think favourably of the work, there are some parts of it which are not skilfully managed, and several inaccuracies in point of fact. The second number, treating upon Geology, may be cited as a proof of the latter, as it ascribes to this science what belongs to mineralogy and chemistry. We are told, for example, that geology "has brought to view inexhaustible deposits of the material for the manufactory of the beautiful pigment under the name of chrome yellow;" and again, that "it has led to the establishment of a manufactory of epsom salts, where seven or eight hundred tons are made in a year!" It certainly was not by the aid of geology that either the chromate of iron, or the magnesian mineral referred to was discovered, nor did it suggest the preparations made from them.

In the number treating of the atmosphere we are told that "from the reflective power of the atmosphere we derive the delightful twilight before the sun rises, and after he has passed from our view." Here reflection is manifestly put for refraction. It is also said that "the atmosphere extends to nearly fifty miles from the surface of the earth." We are unacquainted with its extent, but have abundant reasons to conclude that it greatly exceeds the limit here assigned. Such a statement might be justified by a reference to the older writers on natural philosophy, but is altogether inconsistent with our present views upon this subject.

Notwithstanding these objections, there are some of the numbers of this work which we think merit unqualified praise. The 5th, on the Eye, and the 12th, on the Ear, both written by Jerome V. C. Smith, M. D., are particularly excellent.

Meteorological Observations for November, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Dew point	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches	Inches.				Inches.	
	1	42°	52°	29.60	29.60	42	W.	Moderate.		Clear day.
	2	40	52	.80	.80	40	W.	do.		Clear—flying clouds.
	3	38	50	.90	.94	36	W.	do.		Clear day.
⊗	4	34	54	.94	.90	36	N. S.	do.		White frost—clear—cl'dy
	5	38	52	30.00	30.00	39	NW.	do.		do do clear.
	6	32	50	.10	.10	36	W.	do.		do do clear: cl'dy.
	7	38	56	29.95	29.90	37	W.	do.		do do clear.
	8	42	52	30.10	30.10	31	W.	do.		Clear day.
	9	42	56	.10	.10	41	E.	Calm.		Cloudy—hazy.
	10	48	64	.05	29.94	46	E. S.	do.	.43	Fog—cloudy; rain night.
	11	58	60	29.70	.70	56	SW. W.	High.		Cloudy—clear.
☽	12	38	50	.83	.83	35	W.	Moderate.		Clear—cloudy.
	13	36	48	.80	.60	33	W. SW.	do.		Cloudy—clear.
	14	42	50	.55	.55	37	W. NW.	Blustering.		Cloudy—flying clouds.
	15	40	48	.63	.65	32	NW.	do.		Flying clouds—clear.
	16	34	46	.65	.70	27	NW.	do.		Frost—clear.
	17	32	48	.70	70	31	NW.	Moderate.		Clear day.
	18	38	42	.60	.50	39	E.	do.	.31	Cloudy; drizzle. Rain n't.
☺	19	40	44	.50	.50	32	W.	Blustering.		Clear day.
	20	38	46	.60	.60	32	W.	Moderate.		White frost—clear.
	21	30	52	.60	.50	33	E. SE.	Blustering.		Do clear; cl'yd; rain even-
	22	32	36	28.82	.00	35	W.	do.	.45	Snow, wind high: [ing.
	23	32	42	29.60	.75	26	NW.	do.		Flying clouds.
	24	31	42	.90	.94	26	W.	do.		Clear day.
	25	29	42	30.00	30.00	26	W.	Moderate.		Clear day.
☾	26	32	35	.00	29.85	34	NW. SE.	do.	.03	Cloudy; snow; hail.
	27	38	42	29.95	.90	40	SE. W.	Blustering.	.43	Rain; cloudy.
	28	33	33	.54	.60	22	NW.	do.		Flying cl'ds; clear; light
	29	25	27	.50	.50	10	W.	do.		Clear day. [snow n't.
	30	20	32	30.00	.90	12	W.	Moderate.		Clear day.
	Mean	36.40	46.77	29.77	29.75	33.1			1.65	

	Thermometer.	Barometer.
Maximum height during the month,	64. on 10th.	30.10 on 6,8,&9th.
Minimum do. . .	20. on 30th.	28.82 on 22nd.
Mean do. . .	41.58 . . .	29.26

ERRATA.

Page 147, for continued from p. 40, read continued from p. 89.
There are some other obvious errors; at the distance of the editor from the press, this is unavoidable.

INDEX.

AMERICAN PATENTS, LIST OF, WITH EDITOR'S REMARKS, &c.

END OF VOL. VIII.